

# TOPICS OF THE MONTH

## **Chemical plant industry progress**

**C**ONFIRMATION that neither the competitive strength nor the growth of the British chemical plant industry were being hampered by lack of chemical engineering knowledge, and that a great deal of research had been and was being conducted by British chemical plant manufacturers, is contained in the annual report of the British Chemical Plant Manufacturers' Association, issued last month. This follows the evaluation by the Association's research committee of information collected from members, the universities and research organisations, in relation to the research recommendations in the report of the D.S.I.R. Committee on Chemical Engineering Research published in 1951. It showed that some work was in progress in all the fields of research recommended by that Committee.

A significant development in the chemical plant industry is the setting up of arrangements whereby a plant manufacturer, in dealing with a certain type of enquiry from abroad, can obtain the assistance of appropriate chemical manufacturers in Britain to provide the necessary process details. The need for this arises because enquiries for chemical plant are often received from overseas firms who require, in addition to the plant, full technical details of the chemical process involved. This does not present a problem in relation to plant and processes in common use, but there are often occasions when the plant manufacturer, although fully equipped to carry out the chemical engineering work involved, lacks the process knowledge. Consultation between the B.C.P.M.A. and the Association of British Chemical Manufacturers led to the working out of a procedure whereby the plant manufacturer, through the two associations, can obtain assistance in such cases.

## **Combined desulphurising and sulphuric acid plant**

**D**ESULPHURISATION and sulphuric acid recovery are combined in a new type of plant which is expected to be of particular interest to the steel industry, the gas industry—especially in the case of the larger gas works—and to the chemical and petroleum industries. The plant, which consists essentially of a fluidised hot iron oxide absorber and regenerator, is capable of removing both hydrogen sulphide and organic sulphur to very low levels; at the same time, too, it enables the recovery of considerable quantities of sulphuric acid. The heat requirements of the plant are met by the combustion of the absorbed sulphur and, once started up, it is self-sustaining for heat.

A pilot plant has been in successful operation for

two years, purifying up to 3 million cu. ft. of coke oven gas per day. A full-scale plant, when completed, will deal with 32 million cu. ft. of gas per day. This plant is due for completion by mid-1959 at the works of the Appleby-Frodingham Steel Co., who developed the process. The company says that because the process employs hot gas, it is very much faster than conventional iron oxide boxes or purification towers, while the use of fluidised beds reduces the amount of spent oxide by four-fifths and simplifies its handling and distribution. In compactness and capital cost, it is claimed, the process compares very favourably with existing methods, while the entire operation of the full-scale plant is capable of being handled by two men per shift.

Appleby-Frodingham have appointed two licensees to build plants based on this process. They are Henry Balfour & Co. Ltd. and W. J. Fraser & Co. Ltd. The unit at present under construction at the Appleby-Frodingham works is being built by W. J. Fraser.

## **A Minister of Science?**

**W**HILE the idea of a world ruled by scientists is one that is justifiably repugnant to most people, it is ironic that in a country such as Britain, where science and technology play such an immense and indispensable part in shaping the country's economy and way of life, scientists have so little direct say in how things should be run.

Of more immediate concern, perhaps, is that there does not appear to be any existing means of either formulating or securing a co-ordinated national policy of research, or of directing the many research activities in the country to desired ends. Is there a case for having a Minister of Science, with an overriding position like the Minister of Defence? If not, how is the scientific effort to be mobilised more effectively?

It was such questions as these which occupied the attention of Sir Hugh Beaver, K.B.E., when he delivered his presidential address to the Institution of Chemical Engineers. Sir Hugh did not think that, with the best will in the world, the Lord President of the Council was in a position to be head of the nation's scientific thinking and planning, since he had neither the means nor the time and, secondly, he had only a small part of the field in his control (the bulk of Government research or of research sponsored by or paid for by the Government does not come under him at all). Sir Hugh also ventured to doubt whether the D.S.I.R. in the form and with the methods which were found suitable 40 years ago—and in spite of recent changes it is not now materially different—can discharge the duties that its title envisages. There must be some means of bringing into one coherent policy education,

*i.e.* the production of scientists and scientific leaders; the encouragement and support of research and the allocation of research workers; the widest application of the results of research; and the problems of finance.

Earlier in his address Sir Hugh pointed out that, in the circumstances of modern society, it was inevitable that the State should have an all-pervading influence. The question that had to be solved was whether any government's present arrangements were adequate to meet the demand that the State should mobilise the forces of science to achieve the maximum effect.

### **Anodically protected titanium**

**T**ITANIUM, obviously heading for use in chemical plant in a big way, is now given further advantages in this direction by recent discoveries which extend the range of industrial liquors that it can handle. Typical environments for which the metal can now be seriously considered as a material of construction are hot strong sulphuric, phosphoric, hydrochloric, oxalic and formic acids.

I.C.I. Metals Division report that anodically protected titanium carrying a small impressed voltage can now be considered for use in some most difficult situations. This opens the way for the development of titanium equipment in which fully immersed parts can be protected by supplying current from heavy-duty batteries continuously trickle-charged. A protective potential is maintained irrespective of any temporary cessation of mains supply.

Anodic protection equipment is cheap to install, cheap to run and foolproof. Very little instrumentation is required.

### **Encouraging Middle East industries**

**I**N view of the present political unrest in the Middle East it is heartening to learn of the activities of the newly formed Middle East Industrial Development Projects Corporation S.A. ('Midec'), representing a new departure in commercial activity in the Middle East which may well have far-reaching effects upon the economic vitality and political stability of that area. 'Midec,' which includes some 90 European and American firms in its membership, is aimed at stimulating the inauguration of new, and the development of existing, industrial and commercial companies in the countries of the Near and Middle East. The Corporation is to participate in such ventures, as well as others, and to manage and develop its own investments. With this in view it will investigate suitable projects in various countries in the Near and Middle East to establish operating companies wherever feasible.

The initial list of eight European and one American directors of the Corporation has been announced, with Mr. L. H. Manderstam seconded for one year to act as director of operations. It is anticipated that additional directors will be appointed by countries in the Middle East and Europe.

In the development of industrial projects, 'Midec' will have access to the expert knowledge in many

fields of business and finance of its members, which will be of the greatest value to all participants. Active and close co-operation with Arab private interests is the primary consideration of the company and this object will be furthered by encouraging direct participation by Arab enterprise in 'Midec's' capital and management.

### **Chemicals from gas works**

**N**OTWITHSTANDING the fluctuations and crises that have been experienced in the world market, and competition from petroleum products, the gas by-products industry continues to show itself vigorous and progressive, both from the technical and commercial points of view. A paper given to the Institution of Gas Engineers indicates that, in addition, the value of chemical by-products as raw materials in the national economy is steadily increasing.

A predominant feature of the post-war years has been the steady rise in sales revenue from tar and tar products, but competition is threatening this position. As for benzole extraction, the economics of this will be affected by the falling revenue from motor benzole and the profit margin from crude benzole is not likely to improve except by participation in the chemical market. Whatever method is adopted for its treatment, gas liquor has no real value and now presents a disposal problem rather than being a source of net revenue. Effluent disposal presents formidable technical problems to the gas works by-products plant and the cost of carrying out the necessary processes has a serious effect on the profit from operations.

In the paper referred to Mr. L. W. Blundell describes the by-products operations of the North Thames Gas Board at its Beckton works, and includes some interesting technical details of the various processes involved. Crude by-products include, as well as tar, benzole, ammoniacal liquor and spent oxide, a substantial quantity of carburetted water gas tar. While this finds its main use at present as liquid fuel for steam raising at a number of the Board's stations, it has assumed a much greater significance as a source of industrial pitches and other valuable products. It is certain that greater emphasis will be placed in future on the working up of prepared carburetted water gas tar for chemical purposes, as a means of raising its value in the economics of the water gas process.

Over 130 million gal. p.a. of ammoniacal liquor are treated centrally at Beckton, and a profitable section of this treatment relates to the dephenolation of the liquor before recovery of the ammonia and hydrogen sulphide. The dephenolation has been in successful and continuous operation for 17 years, the process involving the countercurrent washing of the liquor with a special tar oil in a Holley-Mott washer, and subsequent extraction of the phenols from the wash oil by caustic soda solution.

Materials of construction are a most important factor in the successful operation of by-product liquor treatment plants, since corrosion is very severe. Cast iron or mild steel are satisfactory for distillation towers and

storage tanks, and aluminium has proved successful in constructional work. For the hot acid conditions in the saturators, lead must be used, preferably with a tile lining to withstand the abrasive effect of the sulphate crystals. The Haubold centrifuges are constructed with baskets of phosphor bronze and Monel metal, with rubber-lined, cast-iron casings and stainless-steel knife arms. New centrifuges will be fabricated from stainless steel.

A further interesting feature of the operations at Beckton is the manufacture of sulphuric acid in chamber-type plant. Further extension of acid-manufacturing plant is planned, to replace the remainder of the old box chamber plant, which is still producing 8,400 tons of sulphuric acid (100%) p.a. from spent oxide and surplus ammonium sulphate saturator exit gas.

Mr. Blundell concludes that, although alternative sources of supply for the refined products may continue to be found, it is considered that chemicals obtained from coal by traditional means will continue to maintain for many years to come their important position as an integral part of the economy of gas manufacture.

### **Success for Crop Protection and Pest Control Exhibition**

**P**RAISE for the chemists and other scientists who devise new insecticides, verminicides and weed-killers and new methods of applying them was expressed by the Rt. Hon. Tom Williams, M.P., who was for six years Minister of Agriculture, when he opened the Crop Protection and Pest Control Exhibition in London last month. Mr. Williams urged that the long as well as the short view should be taken of the problem of food supplies for the rapidly growing world population. 'For if, as the statisticians warn us, the 2,700-million population today may be 4,000 million before the end of this century, we shall need to win both the battle of scientific food production and its protection and conservation if the people are to be reasonably fed.'

If the purpose of a specialised exhibition is to attract specialists, then the exhibition certainly fulfilled its purpose. The first show of its kind, it was organised by our contemporary, *World Crops*, and held for four days at the Royal Horticultural Society's New Hall, Westminster. More than 50 exhibitors, many of them chemical firms, showed a great variety of materials and machinery for protecting crops and destroying pests. From the first day substantial orders were placed. Many came from abroad to see the show; one exhibitor reported enquiries from eight different nationalities in one day.

The interest aroused by this exhibition certainly encouraged the sponsors and the participants. Already enquiries are being received as to the date of the next one. Whether it will be an annual or biennial event has not yet been decided. When the plans for the next show have been settled, manufacturers of pest control chemicals should lose no time in booking space.

### **New ways with trade effluents**

**A**S usual, some interesting developments in the fight against water pollution are to be found in the annual reports of the Water Pollution Research Board and of the Director of Research, published last month.\* The subjects dealt with include the further study of the condition of the Thames Estuary, the breakdown of detergents during the treatment of sewage, and the experimental treatment of various trade wastes.

The work on trade effluents is of particular interest in view of the announcement in the Board's report of the formation of a joint committee of the Water Pollution Research Board and the Federation of British Industries to advise on problems of pollution in which industry is particularly interested. The Federation is to make a substantial financial contribution to the work of the Laboratory and a considerable expansion in the programme of research on industrial wastes is expected.

The biological destruction of cyanide in percolating filters, which has been proved practicable on a small scale, is now being investigated in a pilot-scale filter containing about 2 cu. yd. of medium. The concentration of hydrogen cyanide has been reduced from 60 to less than 1 p.p.m. when the rate of treatment was 720 gal./cu.yd./day.

A pilot-scale plant is also in operation for treating slaughterhouse waste waters by anaerobic digestion. Over a period of 3½ months the average reduction in b.o.d. (biochemical oxygen demand) varied only between 94 and 97% in spite of considerable variations in load; the lowest period of retention was about 24 hr.

The process of anaerobic digestion, hitherto little used for treating industrial wastes in Britain, is also being tried for treating spent wash produced in the manufacture of whisky. Preliminary laboratory experiments have shown that satisfactory digestion can be obtained if the initial loading is small and is increased only gradually. A reduction of 95% in the b.o.d. has been obtained with a period of retention of 10 days, and work is continuing in an attempt to reduce this retention period.

### **Skim rubber**

**A**RAPID increase in world production of latex has led also to greatly increased output of a by-product of this industry—skim rubber, which is now marketed to the extent of several thousand tons p.a. On economic grounds it is essential to recover the rubber in the skim latex. Experience has shown that the efficiency of the centrifuging process falls as the throughput per hour of field latex increases. The rubber content of skim latex can lie between 2.5 and 10% with corresponding rubber/serum ratios of 1:1 and 4:1. For a particular factory, however, the composition of the skim latex, and of the resulting skim rubber, is likely to be reasonably constant. Owing to the high proportion of non-rubber substances and residual ammonia in skim latex its coagulation by

\* Published by H.M.S.O. for D.S.I.R., 6s.



conventional estate procedures presents certain difficulties, and is usually carried out with sulphuric acid, and occasionally with calcium chloride, formic acid, or by spontaneous coagulation.

These and other facts about skim latex are given by Mr. H. Baker in the Spring 1958 issue of the Natural Rubber Development Board's journal. He points out that skim rubber has an unfortunate reputation deriving from the early days of the concentrated latex industry, when there was little or no control of the marketing of skim and, although the quantity of skim rubber was relatively small compared with the present output, the occasional presence of skim rubber among consignments of regular rubber caused much trouble to manufacturers owing to its abnormal properties and particularly the increased too premature vulcanisation. However, with the increasing quantities of skim rubber now appearing, probably in excess of 10,000 tons p.a., a greater sense of responsibility has arisen and the bulk of skim sheet and crepe produced is labelled and shipped as skim.

Two processes have recently been worked giving skim rubber which resembles regular rubber in many ways, but it is not yet known if the advantages of such treated over normal skim rubbers are sufficient to justify the additional costs of the special processes and the consequent reduction in total output of skim rubber.

### Radiation and safety

**A**NTI-RADIATION preparations, which might minimise the effects of exposure to atomic radiations, have long been the subject of research. Out of such work have emerged a few really promising compounds, but they have so far suffered from the drawback that their administration must precede the radiation exposure.

Recent developments in India suggest that this picture may now well change, reports our contemporary *Atomics*. It appears that methionine, a sulphur-containing amino-acid which had been shown previously effective in preventing excessive radiation damage if given before the irradiation, is in fact more efficacious if given after the exposure. Methionine is very radiolabile, *i.e.* it alters under the effect of radiation, so that if given before radiation commences, the latter may well render it useless, so that no protective action can be exerted. Administration after the dose of radiation allows full use to be made of the protective action.

Methionine appears to be vitally concerned with the synthesis *in vivo* of deoxyribonucleic acid, one of the all-important constituents of cell nuclei, and hence involved in genetic and cell division mechanisms. The methionine plays a part in the processes of transmethylation and phosphorylation which are stages in the DNA synthesis. Hence it is not surprising that it should show value in the repair of tissue damage, including that due to radiations. Methionine has already shown some advantage in the recovery of tissues after serious burns.

### Exhibition and symposium for chemical engineers

**T**HIS month will see an important event for chemical engineers everywhere—the Chemical and Petroleum Engineering Exhibition which is being held at Olympia, London, from the 18th to the 28th of the month. The Illustrated Preview which appears in this special issue of C.P.E. alone provides striking evidence of the importance and scope of the chemical engineering field today. It is fitting that this exhibition embracing both chemical plant and petroleum plant should be held in Britain, where the policy of refining imported crude oil, initiated some years ago, has led to rapid advances in petroleum refinery techniques and has made a powerful contribution to the development of chemical engineering.

The amount of new plant that has been installed in Britain since the war for manufacturing not only petroleum products and derivatives, but many other chemicals as well, is staggering indeed. After such an extensive effort a review of the methods which have been, and are being, used for organising the design and installation of this type of plant seems appropriate. The presentation of a number of papers on this subject under the auspices of the Institution of Chemical Engineers and the Institute of Petroleum will, therefore, be welcomed. The opportunity is being seized of holding a symposium on 'The Organisation of Chemical Engineering Projects,' the subject being divided into seven parts as follows:

- (a) Design Data and Specification of Requirements, including site selection
- (b) System of Project Organisation
- (c) Functions of the Contractor
- (d) Programming and Progressing Systems and Meeting Completion dates
- (e) Cost Estimating and Control
- (f) Plant Commissioning
- (g) The Analysis and Future Use of Project Records.

In general, two papers, by different authors, will be given on each of these parts. Except in the case of (c) one of the papers in each part will be given by a member of an industrial chemical manufacturing firm, and the other by a member of an industrial contracting firm.

The symposium will be introduced in the afternoon of June 24 by a general survey of the problem given by the Managing Director of the Industrial Group of the United Kingdom Atomic Energy Authority. The magnitude of the tasks undertaken successfully by U.K.A.E.A. since its inception is such that a revelation of the methods used by the Authority will be a fitting prelude to the symposium. This will be followed by the Part (a) papers. The papers comprising Parts (b) and (c) will be given during the morning of June 25 and those for Parts (d) and (e) in the afternoon of that day. The symposium will conclude with the presentation of the papers of Parts (f) and (g) on the morning of June 26.

This symposium will also form part of the 1958 programme of the European Federation of Chemical Engineering.



*C.P.E.'s Special Issue  
this month spotlights:*

# **A MILESTONE IN CHEMICAL AND PETROLEUM ENGINEERING**

*... as represented by the Chemical and  
Petroleum Engineering Exhibition, Olympia, London*

## **Chemical Engineering and the Quest for Abundant Power**

**By JOHN A. ORIEL, C.B.E., M.C., M.A., B.Sc., F.R.I.C., M.I.Chem.E.**  
*(Immediate Past President, Institution of Chemical Engineers)*

*As an introduction to our Illustrated Preview of the Exhibition, Mr. Oriel touches on  
some questions of vital importance to the chemical, petroleum and process industries today*

**T**HE Chemical and Petroleum Engineering Exhibition is the first of its kind to be held in Britain, and at the same time the Institution of Chemical Engineers and the Institute of Petroleum are holding a symposium on 'The Organisation of Chemical Engineering Projects.' These have been staged at a most appropriate moment, for the petroleum industry is now expanding fast. The world's demand for oil has doubled in the last ten years, and is expected to double again in the next twelve.

One of the most important considerations in these days is this expanding demand for power. It is, of course, the controlling factor which can make or mar the industrial programme, and therefore deserves considerable attention at the present time.

The total power requirements of the world are increasing by 3% every year and there appears to be no slackening in this pace. We must therefore use all our resources to their limits, and this includes atomic energy as well as oil and coal.

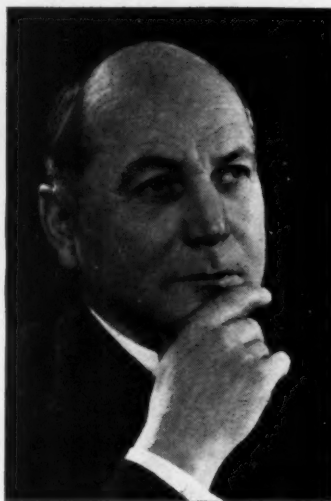
### **New sources of power**

Until recently coal was the largest supplier of energy in the world, but oil has now challenged this position. In the past the main uses of oil were always in the production of motive power, when diesel fuel and gasoline were the most sought-after products. However, now that its convenience and ease of transport are becoming appreciated, other applications are acquiring increasing importance, and its higher cost is often outweighed by

its advantages. Thus, fuel oil heaters are now fast replacing the old coal- or coke-burning types, since their increased cost is amply repaid by their ease of operation, which is often automatic, and their cleanliness. Therefore oil, which has recently dominated the motive industries, is now superseding coal in the heating industries as well.

However, atomic energy, which must be considered to be one of the most remarkable developments of all time, seems to be rapidly catching up on these two. In 1955 Prof. Lewis of the Massachusetts Institute of Technology said: 'It is difficult to estimate the timing of the development of atomic energy as an important commercial source, but there is certainly the possibility that its use may

**Mr. Oriel** is well known for his brilliant pioneering work in the petroleum industry and for his valuable services to the development of chemical engineering. Between 1921 and 1948 he was engaged in a wide range of activities of the Shell Group and, although eventually forced to retire from active management owing to blindness (his eyes suffered damage from mustard gas during World War I), he continues to be very busy as an advisor to the Group in technical staff matters. He is a member of the Royal Institution; a vice-president of the Institute of Petroleum; a fellow of the Royal Institute of Chemistry since 1941; a member of the Executive Council of the World Power Conference; a member of the Chemical Engineering Syndicate and the Board of Studies of the Chair of Chemical Engineering, Cambridge; a council member of the Society of Chemical Industry; and a member of the Board of Advisers on Chemical Engineering at London University.



start within a couple of decades,' and the most that could be hoped was that atomic energy could stabilise the power situation by providing the increased requirements every year. However, Sir Christopher Hinton told the Royal Society of Arts in March that if the development of nuclear power stations could be continued at the present pace, and if the existing upward trend of coal costs continued, nuclear power would be cheaper than that from oil- or coal-fired power stations by 1962. He also said that by 1982 the cost of power from nuclear stations could be expected to be less than half that produced by power stations burning conventional fuels. This amazing change in the situation in such a short time must make us all very chary of attempting forecasts, and one can only hope that in the near future there will be abundant sources of cheap power to satisfy all our needs.

#### **The chemical engineer's part**

Nevertheless, until this happy state has been reached, one of the most important problems to be tackled is the production of as much energy as possible from our present stocks of oil and coal, and it is here that the chemical engineer is of such value. His job is to find ways of extracting as much oil as possible from the deposits, and once obtained, to produce from it the maximum possible power. When a new oilfield is discovered, the most easily obtainable oil is, of course, first extracted, and it is only when this has been nearly

exhausted that the extraction of the more inaccessible oil, from shale or from extra deep or off-shore positions, is attempted. It is in the construction of apparatus for these difficult operations and in their operation and maintenance that the chemical engineer is of such value. He must devise new methods of extracting oil from nearly dry wells and he must study such problems as the wave motion of the sea, in order to construct off-shore drilling rigs. It is only by this wide diversity of knowledge that he has been able to devise ways of extracting oil from deposits which were previously thought to be unworkable.

On the refining side of the business, the chemical engineer must endeavour to have a wide knowledge of the properties and constituents of all the

oil fractions, as well as of their possible applications; with this he must devise equipment which will operate smoothly, efficiently and with the minimum of attention, in order to produce the maximum power from his raw materials. This lengthy list of all his requirements is a measure of the value of the chemical engineer to the petroleum industry, for it is really only since the start of this industry that process plant on this large scale has been required, and chemical engineering has been born. Being therefore a comparatively new industry, its plants have always been modern and up-to-date and automation has always been employed, so that this innovation holds no terrors for the petroleum technologist.

#### **Cheap power and the advancement of civilisation**

These modern inventions in the petroleum industry are changing the face of our private as well as our industrial lives to a considerable extent. Modern civilisation owes a great deal of its leisure to these advances, which are removing a large amount of the drudgery from our everyday lives. The production of power so much more cheaply and cleanly than was ever thought possible before, and the other notable achievements in exploration and application, are a milestone in the history of science. It is in fact by this production of cheap power that manual labour and its resultant slavery have been abolished, and we have acquired an enormously increased amount of freedom. The problem now before us is the application of this leisure to fruitful purposes. Having only recently acquired it, we must endeavour to retain it and out of it achieve something of value.



## **CHEMICAL & PROCESS ENGINEERING**

**will be at the Exhibition. The Editor and Staff**

**extend a warm welcome to all readers at the stand,**

**No. 33 in the Outer Row, Gallery, Grand Hall**



# Preview of the Exhibition

*In the following pages we describe a selection of the exhibits to be shown at the Exhibition. For convenience, these are grouped under the headings of Complete Plants and Processes, Distillation, Heat Transfer, Crystallisation, Filtration, Evaporation, Drying, Centrifuging, Size Reduction, Mixing, Pumping, Instrumentation, Process Equipment, Engineering and Fabrication Services, Fluid Handling, Materials of Construction, Welding and Shot-blasting, Cleaning and Maintenance, and Miscellaneous. Stand numbers are shown in bold type after each item.*

## COMPLETE PLANTS AND PROCESSES

The Power-Gas Group will show various examples of their work in the design, manufacture and erection of plant for the chemical, gas, petroleum, iron-making, nuclear energy and oils and fats industries. As well as heat-exchange and crystallisation equipment, there will be a working model of a Wiggins dry-seal gasholder, which requires only a simple foundation sufficient to support the shell. Another model will be of a large cyclic catalytic oil-gas plant, claimed to be the largest in the world. This *Segas* catalytic oil gas plant, which handles various liquid and gaseous feedstocks, produces a gas with characteristics similar to those of town gas.

Principal items of equipment to be displayed include a heat exchanger, 21 ft. in length, for use in a petroleum refinery, sample welds from a variety of metals including mild and special steels, machined castings and pressure-tested stainless-steel pipework.

The display includes illustrations indicating the nature of extensive contracts completed at petroleum refineries, such as *Girbotol* plants, stabiliser units and off-site facilities, etc. Two processes are illustrated on the stand, a *Hercules* reforming plant for processing industrial hydrocarbons to produce a variety of products, including pure hydrogen, synthesis gases and fuel gases, and the *Texaco* partial oxidation process, by which carbon monoxide and hydrogen are produced from a wide range of feedstocks, including heavy oils, refinery gases and natural gas. Plant for the production of sulphuric acid from all types of sulphur-bearing raw materials, P.A. scrubbers for cleaning industrial gases, the *Krystal* process, and several other processes installed by the companies are also displayed in diagrammatic or pictorial form. (3-K)

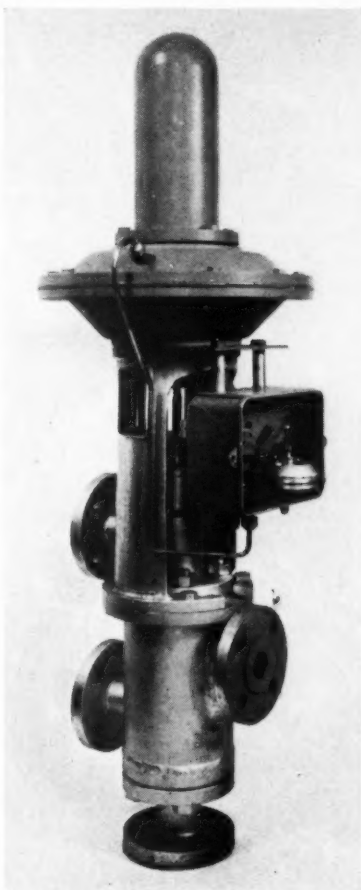
Chemical Construction (Great Britain) Ltd. are particularly emphasising a process for the production of fertiliser-grade urea. Plants with a total capacity of 210 tons/day are now in service with two further plants under construction of 90 and 180 tons/day capacity respectively. The company are able to supply plant capable

of producing urea prills, uncoated but free-flowing, with a bi-uret content of less than 1%. They also have available a newly developed process producing crystal urea with a bi-uret content of less than 0.1%. (14-**Inner Gallery, National**)

Photographs chosen to illustrate a number of complete plants recently engineered and manufactured from flow data will be shown by Metal Propellers Ltd. as well as various distillation and heat-exchange equipment, etc., mentioned elsewhere under the appropriate headings. (11-C)

W. J. Fraser & Co. Ltd. will give examples of their service which covers work from flowsheet to clients' take-over and includes design, engineering, instrumentation, fabrication, purchasing, expediting, erection and commissioning. These services are available separately or collectively. The company's exhibits will include models, diagrams and photographs of large and medium-scale process plant engineered by the company throughout the world and a 10-min. version of the Fraser film 'Experience At Your Service.' Among the models to be shown is one of a plant for the desulphurising of coke oven gas which Frasers are engineering and constructing under licence from the Appleby-Frodingham Steel Co. Also on view will be a model of a fertiliser plant now being completed in New Zealand. A section of the stand will be devoted to the company's fabrication and pilot-scale development facilities. (2-G)

Constructors John Brown Ltd. will have four main displays dividing the sectors of the stand into the various activities of the company. Apart from chemical engineering, there is another sector dealing with instrumentation and automatic process control, which will include full-size exhibits of work in hand. Another sector deals with



Pneumatically operated four-way valve to be shown by Power-Gas.



## COMPLETE PLANTS AND PROCESSES (continued)

pipelines, and included on this stand are two of the company's subsidiaries, Welding Supervision Ltd. and Cathodic Corrosion Control. The international flavour of the C.J.B. activities will be featured in a picture story of the successful laying of the Trans-Iranian pipeline and there will also be examples of work undertaken for the Gas Boards in this country. The display of C.C.C. will highlight the latest methods of combating corrosion in many different circumstances.

The fourth sector deals with the other two main facets of the company's activities, engineering and construction. The work of the Engineering Division is illustrated by photographs of jobs designed and engineered by them. On the construction side we see not only photographs, but a model of a refinery for which they were responsible for the mechanical construction work. (3-G)

The main exhibit on the Head Wrightson stand will be a model of the 'DIDO' heavy water research reactor supplied by Head Wrightson Processes to the U.K.A.E.A. at Harwell. This reactor has already been supplied to the Australian Atomic Energy Commission and erection is almost complete at Lucas Heights, nr. Sydney. (4-P)

Petrocarbon Developments will be showing scale models and photographs of chemical process plants designed and erected by them at home and overseas. These plants range from units for the manufacture of isopropanol and polystyrene to solvent recovery and evaporation plants for thermo-sensitive materials. Of particular interest will be the model of a plant for the production of heavy water by distillation of hydrogen. The process design has been developed in close co-operation with the U.K. Atomic Energy Research Establishment, Harwell. It is based on theoretical, laboratory and pilot-plant work carried out at university laboratories and at Harwell over a period of many years, particularly on the difficult problem of obtaining a high-purity feed gas by freezing out impurities in reversing heat exchangers and 'regenerators.' Refrigeration is produced by expansion turbines, and low pressures below 10 atm. are employed giving low compression costs and minimum maintenance. Simon-Carves Ltd., Stockport, are the engineering contractors for this Petrocarbon-designed plant. (8-O)

## DISTILLATION

The centrepiece of the Cannon (CP) Ltd. stand will be a 200-gal. distillation plant, standing over 16 ft. high, to represent the installations the company undertake. The full range of distillation plant covers capacities from 1 to 1,000 gal. (8-G)

The 6-ft.-diam. stainless-steel distillation column to be shown by Metal Propellers is only one of a number recently completed for export. Others shown in photographs will include the three main stainless-steel distillation columns of Chemstrand Ltd.'s new acrylic fibre plant in Northern Ireland. A 10-ft.-diam. Glitsch bubble tray in stainless steel for Trinidad, and a 3-ft.-diam. *Turbogrid* tray in *Corronel B* for Associated Ethyl Co. Ltd. will be the main distillation tray exhibits. (11-C)

Equipment consisting of a standard solvent recovery unit arranged for electric heating with the new *Isoductive* system will be shown by Kestner. The vessel has a total capacity of 15 Imp. gal. up to the cover flange, and has a heat input of 7.5 kw. maximum with tapings to reduce the input to 5 kw. by steps. The unit is to be flameproof to B.S. 229 and equipped with a hand-control on/off switch. The *Isoductive* heating unit comprises a built-in transformer system, the primary of the transformer consisting of the single-wound toroidal unit completely insulated with silicone resin and glass fibre, while the secondary of the transformer will consist of the wall of the vessel and an annular high conductivity outer ring connector. The wall of the heating unit will be surrounded by a flameproof casing to B.S. 229. The remainder of the equipment consists of an economiser and a coil-type condenser unit arranged as a compact erection on a light framework. (10-E)

A conspicuous feature of the exhibition will be, on the stand of Constructors John Brown Ltd., a *Spraypak* tower in *Perspex*, some 30 ft. high and 2 ft. 6 in. in diam. Far from being a mock-up, this tower will be working under full load conditions and, in order that chemical engineers and others may study the contraflow action taking place within, closed-circuit television cameras will be placed at various points on the tower, so as to give continuous vision on eye-level screens, on the stand. The tower is part of the equipment from the C.J.B. research and development station at Leatherhead. (3-G)

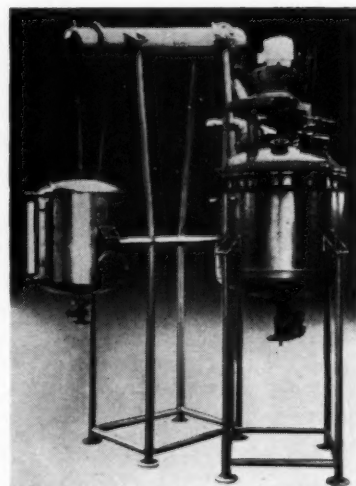
The Q.V.F. Ltd. display of industrial plant in glass will include four overhead assemblies for reflux and distillation. Three of these incorporate single heat exchangers of 9 in. and 12 in. diam. with surface areas of 25 sq. ft. The fourth has an arrangement of two 12-in.-diam. heat exchangers and one 4 in. in diam., with a total area of 55 sq. ft.

One unit to be shown provides a simple and easily assembled means of carrying out reaction under reflux followed by straight distillation. A reflux of the order of 800 lb./hr. of benzene is obtainable.

Another assembly is a general-purpose overhead arrangement essentially for carrying out reactions under reflux followed by straight distillation, such as solvent removal. As an alternative to the first unit mentioned above it is recommended for use under conditions where a rapid increase in boil-up rate can arise as a result of strongly exothermic reactions. This assembly can handle something like 800 lb./hr. of liquid boiling at 175°F. with latent heat of 170 B.Th.U./lb.

The third equipment, in conjunction with an enamelled metal or other vessel, provides a simple, straight distillation unit for either atmospheric or vacuum distillation. This assembly can condense some 800 lb./hr. of *n*-butanol.

Finally there is an arrangement which has been developed for process conditions which give rise to high boil-up rates or to high contents of incondensable gases. It is suitable for use in cases where the reactions are



A distillation unit to be shown by  
T. Giusti & Sons Ltd.

strongly exothermic and the possibility exists of sudden and uncontrollable condensing loads being placed on the heat exchangers. Such conditions may arise from chlorination reactions.

In addition to these items Q.V.F. will be exhibiting *Armourplate* glass tanks and a range of vibro-agitators. (7-Q)

T. Giusti & Son Ltd. propose to exhibit equipment which has been selected from normal production and to place emphasis on distillation plant as this gives a better all-round indication of the company's field of production.

One unit will consist of a 1,000-gal. reaction vessel, stainless-steel column and condenser. The reaction vessel of this unit will have a stainless-steel spiral jacket of unique construction. This specially constructed jacket offers exceptional advantages for heating under pressure and may be used with equal efficiency with a cooling medium.

## HEAT TRANSFER

Amongst the graphite equipment on the stand of Powell Duffryn Carbon Products Ltd. will be a heat exchanger which provides 200 sq. ft. of heat-exchange surface and is in the form of a graphite block 6 ft. in length. This unit is available with either 9 mm. or 30 mm. process liquor holes according to duty. The smallest unit displayed will be one of only 4 sq. ft. heat-transfer area. To demonstrate the working principle of the cubic heat-exchanger design, a full-size working model of a 50-sq.ft. unit has been assembled in *Perspex*. (3-O)

Chemical processing equipment manufactured from *Karbate* impervious graphite will be shown by British Acheson Electrodes Ltd. The main display will be a structure rising to 20 ft. and carrying a complete plant for the production from hydrogen and chlorine of a pure form of anhydrous hydrogen chloride gas, such as is used in the manufacture of chlorinated plastics, e.g. PVC, etc. An *Acheson* graphite combustion chamber with a *Karbate* impervious graphite burner is used for burning chlorine in hydrogen to produce HCl gas. The product which then contains additionally nitrogen, hydrogen and carbon dioxide gases is then fed to a *Karbate* standard model 8A falling-film absorber. The product acid estimated at 33.35% w/w hydrochloric acid is then fed to a falling-film evaporator. The diluent

Jackets of this type have been supplied to a number of customers and are most successful, Giusti state.

The second plant will be of unit construction and consist of a 50-gal. stainless-steel still with inner vessel for use with vacuum or pressure and a jacket for heating by steam. Working in conjunction with the reaction vessel will be a 30-sq.ft. vapour-in-tube-type condenser and 30-gal. stainless-steel receiver. The entire unit will be mounted in framework and connected by stainless-steel pipework. This plant will conform to a standard unit, several of which have been made by Giusti. (5-N)

On the A.P.V. stand will be an 80-ft.-high benzole distillation column, 4 ft. 6 in. diam. This is the centre of a display of models, plates and photographs illustrating work in the continuous and batch distillation of coal-tar products and industrial and potable alcohol. (5-G)

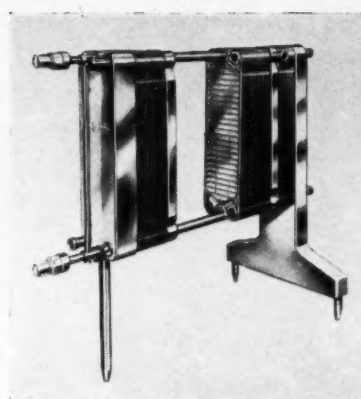
gases are vented off at the top of the tower.

The evaporator is a 19-tube *Karbate* heat exchanger working in effect as a 19A cooler absorber. The source of heat is steam admitted to the jacket. The hydrogen chloride gas is evaporated off leaving constant boiling acid approximately 20% concentration, which is discharged as bottoms acid and is cooled in the series 90A standard heat exchanger.

The second and smaller feature of the stand will be a standard 2-in. model CC-18A *Karbate* sectional cascade cooler to which has been fitted a mixing unit. This equipment is typical of a large number of units which are now operating for sulphuric acid dilution and after-cooling. (13-J)

Combustion equipment to be shown by Peabody is the newly developed LVF combined gas and oil burner. Full information will be available on burners operating in the major petroleum refineries throughout the world, and chemical plants. Large-capacity power station burners for oil, pulverised coal, coke-oven gas, blast furnace gas, and combination of these fuels will be described and illustrated by models.

The method employed by Peabody air heaters producing high-temperature air for drying processes, liquor concentration, petroleum refining and other processes is to be illustrated by



De Laval all-stainless-steel plate-type heat exchanger, shown open to demonstrate easy-cleaning features.

a model in section. The wide application of air heaters will be explained, together with control panels designed to obtain the highest efficiency and economy in the use of fuel oil. (30-Inner Gallery, Grand)

Typical examples of the range of De Laval plate heat exchangers will be shown by Alfa-Laval Co. These units, used in the chemical, food and beverage industries, are claimed to have high efficiency coupled with easy cleaning possibilities. Four models are shown: the very large type P15, an intermediate size P14, and the smallest size P5 in both wall mounting and foot mounting construction. (5-H)

Heat-exchange equipment by Wellington Tube Works Ltd. includes *Weldex* air-cooled heat exchangers; the example to be exhibited will be installed in an important oil refinery. The company report that interest in direct air cooling is now widespread.

Tubular exchangers from the company's comprehensive range are also being exhibited, while an interesting display of plain and extended surface heat-exchange tube will show the scope of modern developments in this field. (4-G)

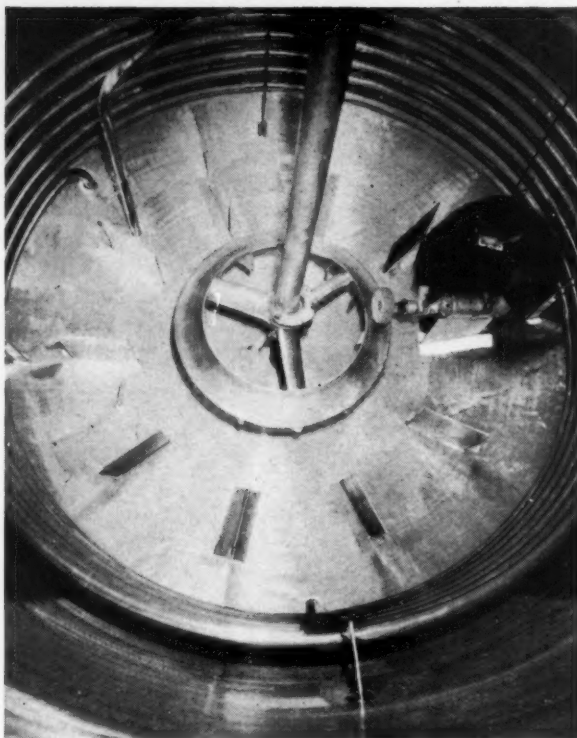
Primary surface oil coolers and heat exchangers for diesel, petrol and oil engine jacket water and lubricating oil, hydraulic couplings, gearbox oil, chemical and petroleum process plant, for liquid and gas cooling, will be amongst the equipment shown by Serck Radiators Ltd. A one-eighth scale model will represent the 'A'-type heat exchanger—a tube fin air blast unit for industrial applications.

Serck Tubes, another member of

the Serck Group, will be showing a range of condenser tubes for heat exchangers, oil, liquid and gas coolers, evaporators, condensers and general engineering purposes. Among the materials shown will be cupro-nickel, aluminium brass, 70/30 brass, aluminium bronze, admiralty brass and aluminium and bi-metals. (7-E)

A. Johnson & Co. (London) Ltd. will be exhibiting special-purpose *Votator* scraped-surface heat exchangers which will be shown for the first time in Britain. Johnsons have for some years been manufacturing *Votator* equipment under licence. Not until now, however, have they made the larger type of heat exchanger which has been developed by Girdlers (U.S.A.) with the chemical industry specially in view. Present production includes machines with heat-transfer surfaces of up to 9.5 sq.ft./cylinder. The larger machines have, however, a surface of 36 or 60 sq.ft./cylinder. At this exhibition, Johnsons are showing a *Votator* exchanger with 36 sq.ft. of heat-transfer surface and provided with a flooded ammonia jacket and ammonia control system. This machine is suitable for cooling viscous materials or alternatively for a crystallising duty. It will be the first machine of this size to be manufactured in Britain, although large *Votator* units for heating and cooling or for crystallising and controlling heat of reaction have been manufactured in the U.S.A. for some years. Materials with viscosities of up to 60,000 cp. have been handled. *Votator* heat exchangers of all sizes are made to utilise heat-transfer media such as water, steam, brine, ammonia, *Freon* and *Dowtherm* vapour and are fabricated in carbon steel, stainless steel or nickel.

A double-scraper *Votator* grease cooler will also be on Johnson's stand. The type of cylinder assembly used on this machine was developed specially for cooling viscous materials which remain viscous at high temperatures and where build up of material on the revolving mutator shaft is likely to result. This type of heat-transfer cylinder assembly has a jacket suitable for water circulation. Within this pair of cylinders is a second pair of cylinders mounted concentrically. Cooling water is also circulated through the annulus formed between the second pair of cylinders. The mutator shaft in this case consists of a tube rotating between the two pairs of heat-transfer cylinders. This



Interior view of Davey, Paxman-built re-crystallisation unit.

tube has four rows of scraper blades fitted into longitudinal slots, two rows scraping the outer and two rows the inner surface.

The grease is pumped through the double annulus formed between the two pairs of heat-transfer cylinders and the mutator tube. The cylinder assembly with its drive and also the water circulating control system are all mounted in a neat sheet-metal cabinet with instruments mounted on the front face. This heat exchanger is capable of cooling between 2,000 and 8,000 lb./hr. of grease, depending on the type and on the temperatures involved. (3-N)

Stainless-steel heat exchangers of 2,000 and 75 sq. ft. heat surface, to be shown by Metal Propellers Ltd., have been selected from a number in course of manufacture. (11-C)

Several new developments in electric surface heaters will be shown by Isopad Ltd. One of the smallest heaters made is the new MIC/VAR *Micromantle* for heating spherical and pear-shaped flasks from 5 to 50 c.c. capacity, as used in micro and semi-micro techniques. At the other end of the scale will be what is claimed to be the largest electric surface heater ever

built. Consisting of several rail-mounted sections, the unit is designed for testing 15-ft.-high, 60-in.-bore valves for nuclear power stations.

*Isomantles* of similar construction for process vessels up to 15 tons capacity are available for all standard vessels made by leading plant manufacturers. Several such heaters will be on view, together with specially shaped units developed in co-operation with makers of pumps, valves, mixers, metering instruments and similar equipment, to ensure their efficient heating. Examples of process plant heaters, ranging from the pharmaceutical to the heavy chemical industries, will be shown.

For cylindrical surfaces, such as columns, standard *Isojackets* are made, while storage tanks up to any capacity can be heated with *Isopanel*s. The latest application of electric heating panels is their use on road tankers (fed from a chassis-mounted generating set) for transporting viscous liquids over any distance. For heating pipelines, a wide variety of *Isotapes* is now available; these tapes are made up to 200 ft. long and from 1 to 4 in. wide.

The display will also include *Isomantles* for drums, both horizontal and vertical, as well as laboratory heating mantles. (7-K)



## HEAT TRANSFER (continued)

Hygrotherm Engineering will be showing a 1-million B.Th.U./hr. *Hygrotherm* patented heat generator and working models demonstrating the principles of the new *Hygrotherm* heat-transfer system for use at temperatures above 700°F. and of the vapour separation system designed to reduce pump cavitation in high-temperature heat-transfer systems. (1-M)

Of particular interest on the A.P.V.

stand will be two bulk heat-transfer systems. The A.P.V.-Heil in-wall cooling and heating system can be applied to a wide range of vessels and provides a large heating, cooling or refrigeration surface utilising the actual vessel wall. The other system is the *Watts* heater which consists of steam-heated cones so disposed that, placed in the centre of a vessel, they create considerable velocity of circulation with a consequent high heat-transfer efficiency and low steam consumption. (5-G)

## CRYSTALLISATION

A working model of a crystalliser, employing controlled crystallisation by the *Krystal* process, will be on view on the stand of the Power-Gas Group, with samples of 835 chemicals which have been crystallised in *Krystal* apparatus. (3-K)

Equipment which can be used for the crystallisation of various substances will be shown by A. Johnson & Co. (London) Ltd., as mentioned

under 'Heat Transfer' on the opposite page. A specialised plant for crystallising paraffin waxes is available. In addition *Votator* apparatus has been used to advantage in the crystallisation of such materials as paradi-chlorobenzene, paranitrochlorobenzene, anthracene, naphthalene, acetic anhydride, potassium perchlorate, sodium chlorate, microcrystalline wax, fatty acids and in the winterising of linseed oil. (3-N)

## FILTRATION

Pipeline filters for removing oil mist, dirt, water and other impurities from compressed-air lines with an efficiency of 99.9% will be shown by Vokes Ltd. These cause no restriction to air flow through filter element and require no attention other than running off the collected liquid and occasionally cleaning the filter element. Air filters to be shown will include the latest *Absolute* types used in the atomic energy, biological, pharmaceutical and photographic industries. A feature of the *Absolute* is its extremely high dust retention efficiency with very low flow restriction characteristics.

Two outstanding Vokes filters to be shown are the *Autoroll*, an automatic screen-type air filter now available with manual operation, and the S.C. rotary screen with special-type filter element which has been developed to meet the need for bulk air filtration, with minimum maintenance and very high dust holding capacities.

An entirely new feature of Vokes oil and fuel filters, which extend to a very wide range of types and sizes, is the *Maxivee* filter element. (4-Q)

Displays by Davey, Paxman & Co. Ltd. will include the 10-sq. ft. rotary vacuum filter, one of a range of filters built for the chemical and allied indus-

tries. Details will also be available of the 1-sq. ft. package transportable filter which has been recently developed for laboratory or site testing and also larger units up to 700 sq. ft. each built for a variety of industrial effluent sludges. (7-C)



Self-cleaning filter by Zwicky Ltd.

Examples of the many shapes, sizes and grades of porous ceramics will be on show by Doulton Industrial Porcelains with sample filter units in which these products are used. Particular interest is likely to centre around special filter units in which the casings are constructed in rigid PVC and a breather filter developed for use with HTP and approved by the Ministry of Supply. (3-Q)

Stockdale Engineering Ltd., who supply *Niagara* pressure filters, are exhibiting a stainless-steel unit which will demonstrate the advantages of a pressure filter in certain filtration problems. The unit is claimed to have a much higher filtration rate per sq. ft. than older-type plate and frame presses. It is also extremely simple to operate and maintain.

Two interesting pilot filters will be demonstrated, one being a horizontal table vacuum filter with 3-ft.-diam. table and the other a 10-sq. ft. drum vacuum filter.

A free-standing, lightweight vacuum filter which demonstrates the use of reinforced resins as materials of construction will be shown by Mendip (Chemical Engineering) Ltd. (26-Outer Gallery, National)

The new self-cleaning filter in the Zwicky Ltd. range is a development of edge straining, coupled with a very efficient comb cleaning which allows continuous operation with a single element. At present the internals are only manufactured in steel and are, therefore, only suitable for oils. The filter is manufactured in a range of sizes from  $\frac{1}{2}$  in. to 2 in. with three degrees of filtration: 0.003, 0.006 and 0.010 in.

Another exhibit here will be the candle-type micron filter in which the degree of filtration is down to one micron, with size according to requirements. The replacement candles are very inexpensive, easily and quickly fitted.

The company's standard products include single and dual gauze filters manufactured in a complete range of sizes from  $\frac{1}{2}$  to 12 in. (2-S)

As well as their new *Zenith Princess* filter, Carlson will have, for small-scale filtration, cylinder filters and a range of laboratory and experimental filters. Further items include a rinsing machine, tincture presses, water scale inhibiting units, as well as ancillary equipment for filtration work. (41-Outer Gallery, Grand)

## EVAPORATION

The Kestner Evaporator & Engineering Co. Ltd. will show a range of plant being supplied by them to clients in the chemical, food and allied industries.

A special item will be a full-scale Kestner evaporator handling sulphuric acid leaving the hardening baths used in the manufacture of transparent paper. This will go straight from the exhibition to be installed to go into immediate production. The calandria on this plant is provided with tubes made of inert graphite and the whole of the construction of the separator, vapour pipes, liquor pipes, condenser, etc., is made of *Keebush* material. The separator is 3 ft. in diam., weighs 3,600 lb. and is moulded in *Keebush*.

A second item will be a double-circulation climbing-film evaporator of the latest design for use in laboratories and for small-scale production of antibiotics, pharmaceuticals, etc., which require evaporation under very low-temperature short-time heating conditions. It is a completely self-contained plant standing on its own framework and requires no external supports. All the materials of contact are stainless steel or glass. (10-E)

A glass demonstration plant will be shown by Nordac Ltd. to illustrate the Nordac process of submerged combustion evaporation as applied to the reconcentration of waste sulphuric acid from the pickling of steel and the manufacture of titanium dioxide pigments. It shows, in addition to the evaporator vessel with its submerged burner, the techniques used to remove the boiling concentrated sulphuric acid from the evaporator and to separate from it the crystals of iron sulphate monohydrate.

The glass plant is a working model in that a miniature submerged burner will be operating on butane gas. The flame is visible through the walls of the vessel and the transparent silica burner tube. The gases from the burner can be seen bubbling to the surface and thermometers clearly indicate that the gases leaving the evaporator vessel are only one or two degrees higher in temperature than the boiling liquid itself.

This evaporative process for recovery of sulphuric acid from effluent streams is making an ever-increasing contribution in the prevention of pollution of rivers both in this country and overseas. The ferrous sulphate monohydrate by-product is not entirely without value in that it can be reconcentrated into sulphuric acid and iron

oxide, thus giving in steel pickling a closed-cycle acid system. In the titanium oxide industry reconcentration of the effluent can be an economically successful process as well as merely preventing river pollution. The crystals separated on the reconcentration of the acid from titanium oxide effluent have in some cases a potential value due to the content of metals such as vanadium. (5a-M)

A.P.V. will show their new plate evaporator in which, by using plates on the climbing- and falling-film principle instead of tubes, an extremely simple and compact evaporator has resulted requiring only 8 ft. of head room. (5-G)

## DRYING

A laboratory spray drier incorporating the Kestner high-speed centrifugal atomiser will be shown on the Kestner stand provided with electric heating. A glass and transparent plastic model of the Kestner TV drier will be operating and it will be possible to see the fluidisation of the wet feed material as it passes up the drying column. (10-E)

The stand of L. A. Mitchell Ltd. will give some account of units for drying petroleum and chemical products of a solid nature either in intermittent drying stoves and cabinets or continuously in a variety of designs of equipment most suited to dealing with the material. Materials dried include catalysts used in petroleum refining processes. The company also install complete sulphur flaking and dispatching facilities in connection with hydrofining plants. (8-C)

The model 51 shelf or tray drier to be shown by Edwards High Vacuum is similar to the blood plasma unit, the principal difference being the replacing of the 'honeycomb' which accommodates the blood plasma bottles on these shelves and a special leading frame is available to facilitate handling. For freezing the material within the shelves refrigerated pipes are fitted, which can be coupled to the condenser refrigerator circuit, and heating the shelves can be effected either electrically or by a heated liquid circulating in a second and independent set of pipes within each shelf. (23-Inner Gallery, Grand)

Adsorption driers and gas generating plant will appear on the Birlec Ltd. stand. The company includes

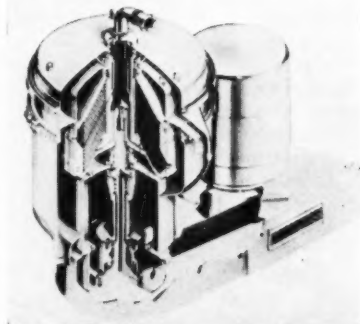
such plant in many of its installations, as well as offering it for other applications in chemical, petroleum and many other industries.

A scale model illustrates the arrangement of large *Birlec* neutral-gas generating plant, of new design, now shown for the first time. The plant operates from town's gas which, after controlled combustion, is stripped of undesired products, leaving nitrogen as virtually the only remaining constituent. The amine solution used in the stripper, where  $\text{CO}_2$  and  $\text{H}_2\text{S}$  are removed, is continuously reconcentrated, using waste heat from the combustion chamber to good advantage. (1-A)

A new design of vacuum shelf drier will be exhibited by Calmic Engineering Co. Ltd. It is available in two types and is intended for the drying of delicate materials sensitive to heat and oxidation. As each drier is composed of a number of independent compartments which can be operated semi-continuously, materials can be dried in one compartment while other compartments are being loaded. Owing to the compartments being small, normally 30 mm. Hg absolute can be obtained within 2 min. of closing the door of the vacuum chambers. (7-D)

## CENTRIFUGING

Alfa-Laval Co. Ltd. are exhibiting some of the latest additions to their range of centrifugal separators. Among the machines exhibited will be automatic self-opening separators designed to make the process operations as automatic as possible. These machines eject separated solids while the machine is running at full speed; there are, consequently, no shut-downs for bowl cleaning. These centrifuges can be fully controlled by an automatic timing device which cuts



DH-6 high-capacity Sharples 'Nozjector.'

out the need for manual supervision. This device is fitted to the type BR-PX 309 model shown. This is the all-stainless 'hygienic' model used for such problems as the clarification of beer wort, fruit juices, instant coffee, molasses, chemical liquors, etc.

A new, smaller, self-opening separator, type PX 207, will also be shown. This is intended for the purification of fuel and lubricating oils, animal fats, etc. In this model the purified liquid is discharged under pressure.

Hermetic separators, also to be on view, separate or clarify liquids with no air contact whatsoever. A new, large, high-efficiency machine has a 23-in. bowl. It is used for such problems as clarifying carbonated beer, cider, perry, etc. Similar two-way separators are used in the De Laval continuous vegetable oil refining process and continuous soap process.

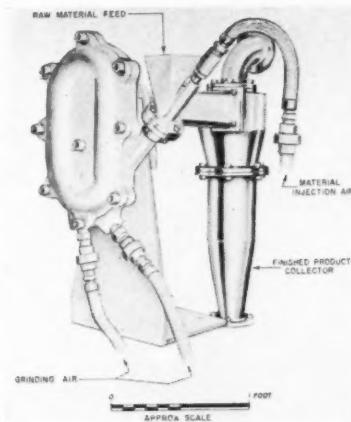
A new De Laval laboratory separator is to be shown. This type of machine follows the pattern of the larger commercial separators and forms a very useful tool for laboratory and pilot-scale work. Other centrifuges to be shown include a horizontal screw-type centrifuge called the *Desludger*, and another machine for treating liquids with a higher sludge content. (5-H)

Sharples Centrifuges Ltd. are exhibiting machines in their complete range of *Super-D-Canters*. By introducing a number of additional models increased coverage is obtained permitting handling up to 200 gal./min. or more of slurries at pressures of up to 150 p.s.i.g. Of special interest are the new P4000 and P7000 *Super-D-Canters* which not only have the advantages of increased capacity and performance but, in addition, have introduced a completely new design concept into the construction of the scroll discharge type centrifuge. These two machines are mounted vertically and have a self-centring bowl.

Sharples are also exhibiting continuous disc centrifuges and especially interesting, both from the mechanical and process points of view, is the new DH6 *Nozjector*. The maximum bowl throughput capacity is in excess of 350 gal./min., and the separating capacity of the bowl is stated to be greater than twice that of the largest disc nozzle centrifuge hitherto built. The mechanical design is interesting in that the bowl is mounted on a flexible spigot support, and that all the operating parts are completely and effectively sealed from the process fluids. Models are available for operation up to 150 p.s.i. (9-H)

## SIZE REDUCTION

An exhibit by Alfred Herbert Ltd. will be the *Atritor* drier-pulveriser, described by the makers as an air-swept unit mill using the true attrition principle for grinding. Drying and grinding are carried out simultaneously in the machine, obviating the necessity for external driers. Hot air for drying is provided by a small coke or oil-fired stove adjacent to the mill and drying can be controlled so that the materials can be completely dried or a residue

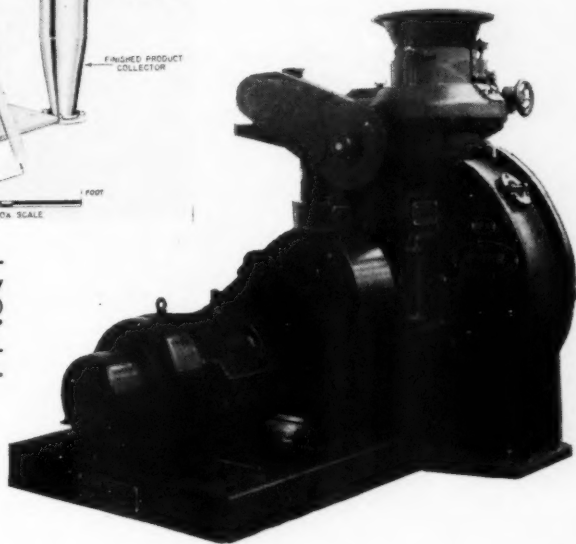


Fluid energy reduction mill by Kek Ltd. (above) and (right) 'Atritor' pulveriser by Alfred Herbert Ltd.

Materials containing up to 80% moisture can be handled and the drying efficiencies of 75 to 80% are regularly achieved, the makers state. An important feature is that maintenance (due to the modest speeds of the machine by comparison with other mills, its general design and special material used for the grinding parts) is of low cost per ton and the replacement of wearing parts can be accomplished in a very short time.

The external-fan-type *Atritor* is a development of the standard internal-fan design, its purpose being to provide very coarse gradings where required. (9-J)

The theme of the Kek Ltd. display is based on the use of fluid energy reduction jet mills for the continuous grinding of solids, ranging from heat-



moisture retained, dependent upon requirements. Grinding can also be controlled by a simple adjustment to the *Atritor's* internal parts, enabling either a superfine face-powder-like or a coarse granulated product to be obtained with various intermediate gradings as required.

Wet, sticky materials including sludges, filter cakes and semi-liquids can be handled satisfactorily, although a small amount of preparation of the material prior to feeding into the *Atritor* may be necessary when dealing with high moisture contents. It is emphasised that this preparation is required purely for feeding purposes; once inside the mill, drying and grinding is carried out in a single swift operation.

sensitive soft waxes to hard abrasives, down to low micron particle size. The principal exhibit will be a model 0202 *Jet-O-Mizer*, the smallest mill of this type. Kek are the sole agents in the U.K. for Fluid Energy Processing & Equipment Co., who developed the *Jet-O-Mizer* in the U.S.A. Specifically these improved fluid energy mills deliver micron and sub-micron products of much narrower distribution range than is obtainable with other types of grinding equipment and they are successfully used for reducing hard talcs, clays, ceramics, metals, pigments and many chemicals. In addition, however, *Jet-O-Mizers* can achieve many other functions simultaneously with fine grinding, such as dehydration of wet materials, coating



of fine particles with other materials, and chemical reactions. Samples of materials milled in the *Jet-O-Mizers* will be available on the stand, together with a microscope in order that their particle size may be examined.

Also open to inspection on the stand will be an improved version of the *Minikek* pin disc mill developed for small batch production work. To facilitate the changing of receiving drums or sacks, the *Minikek* is fitted with a small cyclone collector and, in the case of the mill on view, both the cyclone and the delivery ring are *Epikote*-lined. (18-A)

The main exhibit of Torrance & Sons will be the recently developed unit for continuous dispersion and/or fine grinding of solid particles in the liquid phase. This is believed to be the first 24-hr./day non-attention automatic plant of its kind. A batch-type unit employing the same dispersing principle will also be on view. (5-M)

A new machine which effects fine grinding with close control by high-frequency, small-amplitude vibrations is to be shown by Wm. Boulton Ltd. This all-British machine has been developed in conjunction with W. Podmore & Sons Ltd., of Shelton, Stoke-on-Trent. (14-*Inner Gallery, Grand*)

On the Doulton Industrial Porcelains stand, hard porcelains will be shown used as ball mills and as linings for grinding mills. A ball mill of entirely new design is being displayed for the first time. Examples of grinding balls, ball-mill lining blocks and cyclone nozzles—in a new alumina-loaded porcelain claimed to have superior strength and resistance to abrasion and thermal shock—are also included in the exhibits here. (3-Q)

In addition to their centrifugal machines, Sharples Centrifuges Ltd. are showing equipment typifying their activities in dry powder technology. A micromerograph is exhibited illustrating the company's activities in the field of particle size analysis, and the *Super Classifier* which opens new possibilities for dry powder classification at very low particle size cuts.

Details are available for the first time in Europe of the new K8 *Super Classifier*. This unit has a capacity range of up to 250 lb./hr. feed, and is stated to be excellently suited for laboratory and pilot-plant application. (9-H)

## MIXING

L. A. Mitchell's mixers in a wide variety of designs are used in the petroleum industry for product blending and chemical treatment. Side-entry mixers up to 30 h.p. are standard equipment in many refineries for large-scale blending operations and the company's special designs of turbo and other types of impeller heads are used in reaction vessels, chemical treatment process tanks, etc. (8-C)

Gardners of Gloucester are designers and manufacturers of a range of mixing, sifting, drying, grinding and other types of machines and plant, and the main exhibit will be a 14-ft.-diam. stainless-steel, double-cone mixer, which the company believe to be the largest mixer of its kind to be manufactured. This particular machine is for export and will be used in the plastics industry.

For comparison the company will also be showing in operation an 8-in. stainless-steel double-cone laboratory mixer.

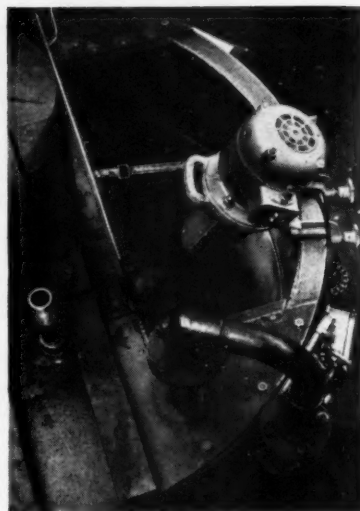
Also on the stand will be a 6-ft.-long band conveyor complete with four-speed reversing gearbox and magnetic clutch. (6-N)

Winkworth Machinery's main exhibit will be a heavy-duty 36-gal. double 'Z' blade production mixer complete with hydraulic tilting and 25-h.p. motor, fluid coupling and direct coupled reduction gear. (2-K)

A newly developed portable mixer known as the *Metamix* is equipped with a gear which is infinitely variable. It will be shown by Metaducts Ltd. (12-*Inner Gallery, National*)

Interesting units to be shown by Wm. Boulton Ltd., ceramic and process engineers, include a double-paddled stirrer for granular or powdered solids in a vessel having a conical or domed base, the paddle functioning to impart a component of axial and radial circulation, thus reducing the tendency for the solids to form a layer at the walls. It is made for general use in industry under licence from the Atomic Energy Authority and offers many advantages for use in solid gas reaction vessels; also a 44-in.-diam. gyratory screen and a Muller mixing machine which can be supplied with cast iron, granite or porcelain rollers. (14-*Inner Gallery, Grand*)

W. J. Fraser & Co. Ltd. are showing the *Nauta* mixer as one example of



'Universal' mixer mounted on the side of a vessel (Premier Colloid Mills Ltd.).

the company's range of special-purpose plant. The *Nauta* is a countercurrent mixer for liquid-solid or solid-liquid mixing and has attracted considerable interest in previous exhibitions in Europe. (2-G)

Stockdale Engineering Ltd. will be showing for the first time their new, spiral-bevel, agitator-drive gearbox which is capable of transmitting up to 50 h.p. at various speeds. Changing of output speeds is easily effected by a simple set of change wheels, thus eliminating the conventional Vee-rope drive.

On this stand also a *Flomix* unit will be shown under simulated working conditions and visitors will be shown the mixing action of this machine through transparent pipes. (12-C)

Premier Colloid Mills Ltd. now have a complete range of mixers which will handle quantities from 1 to 30,000 gal. and more. The company are able to supply mixers of all sizes with either marine-type propellers for general work, turbines for slow agitation, and *Dispersators* which are used in dispersions and emulsions and any other applications where intimate and high-speed mixing induced by shear conditions are required.

Also on the stand will be a prototype of a continuous mixing unit. The advantage of such a unit is that the mixing throughput can be many thousands of gallons per hour and yet the equipment is extremely small as compared with the usual tanks and mixer arrangements. (4-C)

## MIXING (continued)

Baker Perkins Ltd. will show a number of their mixers, including a machine which is suitable for dry rubber mixings, is quick-acting and tilts to discharge the complete mass. Having no bottom outlet, liquids can be added to this type of mass. Another exhibit, an extruder with 50-h.p. drive, is suitable for dealing with all thermoplastics and has a separate drive. It is a single-screw extruding machine with

a single starter thread and the worm ratio is 15 to 1. The barrel has four temperature controlling sections, one cooling section and the worm is also cooled.

A machine for development, experimental and pilot-scale production is the 1½-in. extruder with dye water bath and haul-off equipment. The haul-off gear is suitable for 'tube and sections.' A most versatile and flexible machine. The *Flowmaster* reactor unit, also to appear on this

stand, is a mechanical heat-exchange unit containing a number of intense mixing chambers suitable for dealing with material in a slurry form or rather stiffer, until the stage of a light dough is reached.

The size 8 *Universal* mixer is designed for experimental and development work. Blade speeds can be varied, speed ratios can be changed and different types of blades tried out in hot, cold, atmospheric or vacuum conditions.

## PUMPING

On the Kestner stand, a *Keebush* tank with a glandless acid pump made of the same material will be connected to a pipeline and will be operating. The principal object is to demonstrate the glandless feature of the pump. (10-E)

Some typical examples of the De Laval easy-clean stainless-steel centrifugal pumps are to be shown by Alfa-Laval Co. Ltd. These include the type 5/50 centri-axial pump for low liquid turbulence, and the defoaming pump for pumping frothy liquids. (5-H)

The L. A. Mitchell centrifugal pumps manufactured in corrosion-resisting corundum body find application in the petroleum chemical industry as they are resistant to all acids other than hydrofluoric acid and have a high-resistance to thermal shock. (8-C)

On the Zwicky Ltd. stand it will be shown that a very comprehensive range has been produced for all purposes, including transfer of oil, water and certain chemicals. A pump has been designed especially for use with *Dowtherm* and another as a boiler lighting-up pump in marine-oil-burning installations. (2-S)

A new chemical pump introduced by British LaBour Pump Co. Ltd. will be on view for the first time on their stand. It is of their new SZ range of pumps, specially designed for chemical service. Particular attention has been paid to ease of maintenance and service, and the impeller and internal components can be removed for inspection without disconnecting suction and discharge pipelines, or disturbing the motor.

These new pumps, which are available as flooded suction units and will be of enormous interest to all who need chemical pumps, will be aug-

mented by examples from the well-established range of British LaBour pumps. One of outstanding interest is the type UZ pump for handling hydrochloric acid, ferric chloride solutions, etc. *Vulcoferran*-lined, it is fitted with a special mechanical seal, thereby obviating the use of special and very expensive metal alloys.

A fairly recent development is the type USL pump, made specifically for mines and designed to operate in confined spaces. It is a self-priming pump incorporating a special mechanical seal which does not require lubrication or external cooling, will run for long periods on 'snore,' and does not require a foot valve.

A pump of outstanding performance is the type BG, developed from the type G. It is a vertical pump and functions without packed gland or mechanical seal. It is particularly suitable for applications in which maintenance must be at an absolute minimum, and for handling corrosive and dangerous liquors.

A sectional model is used to demonstrate how high efficiency is obtained

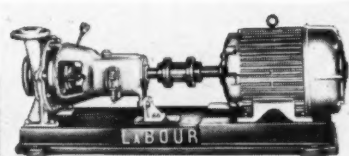
with the types DZT and Q pumps, and their ability to handle a high proportion of gas or vapour with the liquid. Both types are the LaBour open-impeller design for flooded suction.

LaBour pumps UHL/UPL were recently modified. The pump bodies remain virtually unchanged, but new bearing and impeller assemblies have been introduced. The pumps are of the well-known LaBour self-priming type and are available in a wide range of corrosion- and erosion-resistant materials, including the special LaBour nickel alloy R55.

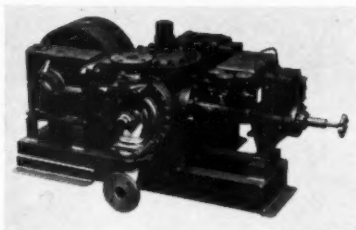
Type SGHL pumps have been developed for vacuum extraction duties and are used in conjunction with vacuum filters, evaporators, condenser installations, etc. These pumps will extract liquor from vessels under a 28-in. vacuum. The design incorporates a seal-bath whereby the gland is totally immersed, to prevent air entry when running under vacuum conditions. LaBour corrosion-resistant alloys are available for appropriate duties. (16-K)

Astral Industrial Meters will have *Feed-a-Pumps* for continuous blending, proportioning and sampling purposes. With these units almost any number of constituent fluids can be blended in accurate proportion, the cycle being controlled either by master meter or alternatively by a motor-driven control valve. Also to be shown is the Astral refuelling pump and meter. (21-*Inner Gallery, Grand*)

Girdlestone Pumps Ltd. are exhibiting their new self-priming centrifugal pump for the first time. This unit is of the latest design and is available in a number of metals including cast iron, gunmetal, zinc-free bronze and stainless steel. It incorporates mechanical shaft seals exclusively and is capable of drawing a high vacuum and delivering against heads up to 60 ft.



British LaBour type SZ pump.



Piston diaphragm pump, E.C.D.

Numerous other pumps and float switches will be shown and of particular interest is the glandless diaphragm pump for handling corrosive and abrasive fluids. (7-*Inner Gallery, Grand*)

Appleton & Howard Ltd. will appear on a stand with their parent company, William H. Capper & Co. Ltd. The Appleton & Howard section of the stand will be devoted to the presentation of a range of centrifugal pumps and valves for the chemical and process industries. The range of *Gush* centrifugal pumps includes both the horizontal externally mounted and submersible types, in sizes from  $\frac{3}{4}$  to 6 in. These generally incorporate mechanical seals, but provision is also made for the fitting of stuffing boxes and glands of the easily repackable type.

The company will display a total of 12 pumps of both the horizontal and submersible types, ranging in size from  $\frac{3}{4}$  to 6 in., fitted with metallic and also plastic components and, of these, three pumps will be actually working. Of particular interest are the prototype oil process pump with water-cooled bearings, the centrifugal pump with special jet attachment giving constant-flow characteristics against varying heads, which is particularly suitable for filter press work, the 'S'-type submersible unit, and the small, plastic, general-purpose *Minnow* pump.

The 'S'-type submersible pump is one of a number the company have manufactured for the United Kingdom Atomic Energy Authority, for the handling of all concentrations of hydrofluoric acid at heads up to 160 ft. The main components of this pump are constructed from *Monel* metal, but the unit also incorporates a special design of pure solid PTFE submersible bearings which are operating successfully at speeds up to 2,900 r.p.m.

The *Minnow* pump is a small, general-purpose centrifugal unit complete with direct-mounted, shaded-pole, driving motor, which incorporates a special thermal overload device to guard against the possibility of winding failure. The wetted components are constructed from moulded high-density polythene. The complete unit weighs only 4 lb. (9-D)

Representative pumps from their ranges for the chemical and oil industries will be shown by Sigmund Pumps Ltd. including:

**B-N stainless-steel chemical pump.** The B-N is an excellent example of standardisation in manufacture which meets a wide range of applications in the chemical industry. The basic material is 18/8/3 stainless steel, with alternatives of *Paralloy*, 18/8/Ti, zinc-free bronze or all-iron construction. The range of nine pumps, covering outputs up to 250 gal./min. and heads up to 350 ft., uses only two sizes of support frames and bearing houses. Although a comparatively cheap chemical pump, the B-N is suitable for operating at temperatures up to 250°F. (120°C.) and, with cooled bearing housing and mechanical seal, can be used on operating temperatures as high as 450°F. (232°C.).

**A-N heavy-duty chemical pumps.** This single-stage unit is specially developed for applications in the chemical industry where a really heavy-duty pump is required on duties which permit foot mounting, but which necessitate the widest variety in material specifications. Typical materials of the range are alloy cast irons, chrome nickel steels, special bronzes, high-nickel alloys, cast steel, silicon aluminium, *Monel* and chrome steels. Shaft sleeves are of special material or *Colmonoy* faced, according to the application.

**W-A-N pumps.** This range of vertical, glandless acid pumps has been used for many years in the handling of sulphuric acid, oleum and similar chemicals. It can be submerged in the liquid or fixed on the side of tanks; the flooded suction then obtained avoids the priming difficulties associated with horizontal chemical pumps, the makers claim. In addition, the liquid never reaches a higher level on the shaft than the liquid level in the tank, so that there is no difficulty regarding stuffing box sealing or packing.

**HO-N pumps.** This is the standard, single-stage, single-suction, high-temperature process pump in the Sigmund range, designed specifically for the maximum duties required of process pumps and suitable for operating temperatures up to 900°F. (480°C.) and pressures up to 450 p.s.i. (6-A)

E.C.D. Ltd. have developed a type of special diaphragm pump designed to meet individual specifications which is able to withstand pressures up to 2,000 p.s.i. Single units have capacities of up to 500 gal./hr., and double and treble units up to 2,000 gal./hr. The pumps are fluid-operated and their output is continuously variable from zero to maximum. They are fitted

with manual capacity control or with pneumatic control for remote operation and automatic speed variation. Accuracy of control is ensured by a ground and polished plunger which, continuously immersed in the operating oil, works in the lapped bore of the piston. A feature is the absence of any end thrust, pins or levers which might cause wear. A single flameproof motor can be arranged to drive each pump unit through a variable speed gear, coupled to a pneumatic positioner which is in turn controlled by a process variable. Fluid ends can be made in metals or plastics which will resist the corrosive action of whatever fluid is to be pumped. All units are fitted with double suction and delivery valves. These incorporate replaceable seats which can be removed without pipe joints having to be broken. (7-*Outer Gallery, Grand*)

Edwards High Vacuum Ltd. will show two fractionating diffusion pumps in which a special arrangement of the jet assembly ensures that the purest oil only is maintained in the high-vacuum stages and an ultimate vacuum of better than  $5 \times 10^{-7}$  mm. Hg can be attained. Also on this stand will be the latest *Speedivac* pumps, completely redesigned without in any way sacrificing their vacuum performance, and claimed to be one of the quietest-running air ballast pumps in the world.

The 30B4 booster vapour pump has the same pumping characteristics as the earlier models in their range, but has been designed for use on large-scale metallurgical and chemical plant. (23-*Inner Gallery, Grand*)

Pumps specially designed for handling volatile or corrosive liquids as well as liquid metal and fused salts under extremely high temperature conditions will be shown by Rhodes, Brydon & Youatt Ltd. The 1½-in./VII sulphur pump is typical of a range of pumps which can be used for pumping mined sulphur or refined sulphur. The pump casing is self-draining and an open-type impeller is fitted. (4-J)

Worthington-Simpson Ltd. will be showing a representative selection of chemical, petroleum and power pumps together with rotary and *Monobloc* air compressors. Of special interest in the chemical field will be a new flameproof pump in the *Monobloc* construction. Another new feature will be a pump constructed in *Hastelloy B*—the latest addition to this range. (7-O)



The equipment displayed by George Fletcher & Co. features the *Amarilla* rotary displacement pump which is made in a wide range of sizes for handling sludge, heavy oil, semi-fluids and thick mixtures of slurry, pastes, etc. This pump is made in sizes from 2-in.-bore delivery, capable of handling viscous fluids at the rate of 500 gal./hr. up to 7-in. bore delivering 6,000 gal./hr., and can be arranged for direct coupling to an electric motor mounted on a combination bedplate, or for Vee-rope drive. (13-E)

Amongst the exhibits of Mono Pumps will be a new unit which can be used in chemical plants to pump powder through pipelines. This pump enlists the aid of air injection to fluidise the powder. Another new Mono pump is designed for handling pharmaceutical products where a high degree of hygiene is required.

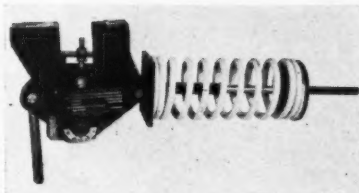
Glandless, self-priming diaphragm pumps with contacting parts of chemical rubber, *Neoprene*, various plastics, stainless steel, etc., will be shown by Merrill Pumps Ltd. (3-A)

Metering Pumps Ltd., the new company which takes the place of the chemical pumps division of the Candy Filter Co. Ltd. (see 'Company News'), will show a plant comprising a *Minor* metering pump driven by means of a constant-speed motor through a variable-speed gear and a worm reduction gear. This type of equipment is recommended when a supply of instrument air is already available on site so that it is possible to take signal air at a pressure of from 3 to 15 p.s.i. lineally related to the varying rate of flow (that is to say, incorporating a square root extractor in the flow meter).

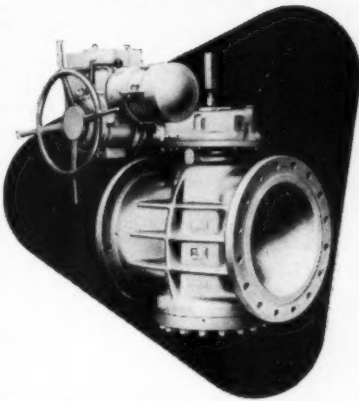
This signal air supply is taken to the diaphragm head of an air motor causing the position of the spring-loaded diaphragm to alter depending on the pressure. The spindle of the diaphragm connects to the hydraulic relay control of the variable speed gear so that at an input air pressure of 15 p.s.i. the variable-speed gear has a maximum output speed of 1,420 r.p.m. and at an input pressure of 3 p.s.i. the output speed from the variable-speed gear is zero.

It will be seen, therefore, that the speed of stroking is varied in proportion to the varying rate of flow and to adjust the dose it is only necessary to vary the length of the stroke manually. (17-A)

## FLUID HANDLING



Vokes Genspring's 'M' range constant-support hanger.



A 16-in. Class 150 carbon steel 'Hypre-seal' valve fitted with a 'Rotork' electric actuator (Audley Engineering Co.).

Among the exhibits on the Zwicky Ltd. stand will be a range of constant-pressure and pressure regulating valves. These valves have been designed mainly for use in ring main oil-burning systems between  $\frac{3}{4}$  in. and 2 in. bore, but are also suitable for most other liquids. The pressure regulating valve acts as a relief valve and maintains a constant pressure in the ring main upstream of the valve, while a constant-pressure valve in each feed line will maintain within very fine limits a steady downstream pressure. (2-S)

The *Annin Domotor* control valve from the U.S.A. is now to be produced by the Audley Engineering Co. Ltd. in the U.K., where it will be known as the *Audco Annin* valve. Examples of the valve will appear on the Audley Engineering stand. The valve has as its basic form a globe body designed to provide for conversion into straight-through, angle or three-way forms with a minimum of parts. The valve is of split design and consists of a body and adaptor. This type of construction provides a single-seat design which retains an internal contour of the same area as the relating pipe size. The body flanges retain the seat ring in perfect alignment with the valve body.

The *Audco Annin Domotor* is a precise positioning and fast pneumatic operator. The unit consists of a dome with built-in positioner and piston providing power, stability and positioning accuracy. An outstanding feature which contributes largely to its usefulness as a control valve operator is its positional stiffness. A deviation of but a few thousandths of an inch of the piston rod from its rest position is sufficient to provide a restoring force of the maximum rated value. The unit also provides rapid response with no tendency to over-shoot the control position.

Lubricated taper-plug valves manufactured from a wide range of materials, including cast iron, carbon, alloy and stainless steels, bronze, *Monel* metal and aluminium will be exhibited. These include straightway, multiport and steam-jacketed designs. Pressures from the finest vacuum up to 5,000 p.s.i. are catered for, and sizes range from  $\frac{1}{4}$  to 24 in. bore.

A Christmas-tree wellhead assembly will also be displayed, together with examples of remote-controlled, pneumatic and electrically operated *Audco* valves. (6-E)

The Stockdale Engineering Ltd. stand will include a display of lead-lined/mild-steel pipework together with samples of Stockdale 'Y' valves and rubber-sleeved *Stelco* pinch valves. (12-C)

The Emco Brass Manufacturing Co. Ltd. are exhibiting the Emco-Wheaton range of petroleum and oil marketing equipment. This equipment consists of the fluid handling accessories on road and rail tank trucks and also the bulk loading assemblies for filling trucks at storage installations.

Among exhibits will be a B690 loader in brass used mainly for petroleum and oil—this loader could be made in metals to suit any particular liquid required. (28-Inner Gallery, Grand)

A range of straight-through diaphragm valves, especially suitable for chemical duties, will be featured by Wynn (Valves) Ltd. There will be two air-operated valves which will be shown in operation. Both will be of 2-in. size—one of the air-opening, spring-closing type, the other of the spring-opening, air-closing type.

Three of the new model 6-in. valves will also be presented, one in cast iron and with position indicator, another in cast-iron with glass-lined

## FLUID HANDLING (continued)

body and with double-acting air cylinder operation, and a third in cast iron with ebonite-lined body. Amongst stainless-steel valves will be one specially designed for handling milk, and another, of 2-in. size, with angle-type body.

There will be valves and top assemblies to show the various methods of operation available, and there will be valves completely cross-sectioned. (12-K)

On the stand of the W.K.M. Valve Co. valves will be on exhibition and also a Christmas tree of British-made W.K.M. valves erected by Le Grand, Sutcliffe & Gell. (11-D)

An electro-hydraulic power package unit which operates valves in any remote location and at any distance from the control point is the latest addition to Richard Klinger Ltd.'s range of automatic valve equipment. It will be on public display for the first time at the exhibition.

The power package unit operates *Klinger* piston valves of from 2½ to 8 in. and might be used for other valves of suitable construction. It is completely self-contained and need only be connected to an electricity supply to become operable. It can therefore be used in the most remote locations, provided only that a suitable electricity supply is available. It is so constructed that it can be used in any position—upright, horizontally or upside-down. The electric and hydraulic parts are housed in dust-proof compartments.

The *Klinger* piston valve lends itself to remote control by air and hydraulic operation. The fact that the valve has no seat, but is sealed by resilient packing rings which are compressed around a sliding piston, means that power is only required to move the piston from one position to another, and no power is required to maintain the valve in the open or closed position. The operation of the valve is achieved by mounting a double-acting air or hydraulic cylinder on the top flange of the valve body by means of four supporting columns. The valve piston is connected to the piston rod of the operating cylinder by means of a straight spindle. Valves of 1½-in. bore and over are of the balanced-piston type and the spindle is sealed by a stuffing box. Tapped air or hydraulic connections are provided at each end of the operating cylinder.

Valves are manufactured with

bronze, forged or cast-steel bodies ½ to 6 in. bore and have stainless-steel pistons and spindles as standard. The air-operated version gives a rapid opening and closing. Control of the valves is provided by a small hand-operated valve or push button, which can be situated 100 ft. or more away. A number of valves can be operated simultaneously by the same control, or a single valve can be controlled from more than one station.

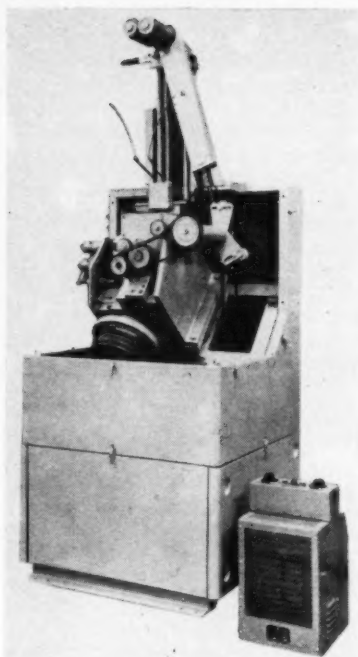
*Klinger* hydraulic-operated valves give positive control in any position and gradual opening and closing. Control of the hydraulic valves is provided by oil pressure, generated by a pump, which is transmitted to the operating cylinders through metering, reversing and selector valves. The selector valves can be either hand or electrically operated.

As well as valves, Richard Klinger will have jointings of compressed asbestos in sheets or in precision-cut gaskets. Compressed asbestos jointing is available for all pressures and temperatures, superheated and saturated steam, chemicals, gases and hydrocarbons. Wire-reinforced compressed asbestos jointing is available for pulsating pressures and temperatures of spark and compression ignition engines.

Cocks and liquid-level gauges will also appear. (1-C)

Liquid meters to be shown by Astral-Rockwell on the stand of Astral Industrial Meters Ltd. cover a wide range of applications in the petroleum, chemical, water distribution and process industries. Rotary piston meters, from ½ to 3 in., are suitable for small and medium flows. For bulk handling the Rockwell *Rotocycle* meters are available with their high throughput and low pressure loss. Multi-stage shut-off valves, air eliminators and meters for liquid propane gas will also be shown. All types can be arranged for batch dispensation and in some cases remote control and temperature compensation is available. (21-**Inner Gallery, Grand**)

A reinforced-resin piping system will be shown by Mendip (Chemical Engineering) Ltd. Effort has been concentrated on provision of a joint which can be made by an inexperienced operator on the site with relatively cheap equipment. All pipes and fittings have half olive cast at each end. If it is required to make a length of pipe less than the 10-ft. standard supplied, the pipe can be cut with a hacksaw and, by using the simple technique



Burtonwood Engineering will show this 7-in. vertical stair-step dicing machine.

which has been evolved, together with a mould provided, a half olive can be cast in approximately 30 min. (26-**Outer Gallery, National**)

Vokes Genspring Ltd. will be featuring their new 'M' range constant-support hanger which has innumerable applications wherever piping in industry requires careful control of stresses and strains.

Variable support hangers will also be shown alongside a recent development, the *Sway Brace*, which, as its name implies, prevents sway and controls horizontal vibrations in piping systems. The heavy-duty 'W' range of constant-support hangers will be featured and illustrations will show their use at Calder Hall and Chapel Cross. (4-Q)

B.K.L. Alloys Ltd. are exhibiting their range of *Tubend* tubular welding fittings. Elbows, tees, return bends, caps and reducers are manufactured for the petroleum and chemical industries. (1-S)

A new valve expected to be especially useful for 'tough-spot' applications where a really positive shut-off is required will be shown by Joshua Hindle & Sons Ltd. The valve has a double sealing action. In addition to the metal-to-metal fit of the wedge

against the valve seats, two *Fluon* seals contained by stainless-steel rings are compressed against the wedge as it is lowered. The valve is available in carbon steel or stainless steel.

An imposing exhibit on this stand will be a very large cast stainless-steel gate valve. With companion flanges and gearing it weighs over a ton and stands nearly 10 ft. high. Other exhibits will include stainless-steel gate, globe, flush outlet, oblique, check, steam-jacketed, pressure-relief, float and needle-control valves; liquid level gauges, strainers and sight flow indicators; and a variety of cocks, special valves and pipe fittings in many grades of stainless steel.

Sight flow indicators will be the main exhibit of B. Rhodes & Son Ltd., a range of different types including the spinner type for cooling water circuits or similar applications. Features include an impeller of gunmetal and a fixed axle of stainless steel.

Other products of this company include the *Sergeant* safety valve and a number of other valves and cocks. (30-Outer Gallery, Grand)

Meynell & Sons will show a new stop valve which has been developed on the Continent for handling corrosive fluids and also the company's steam/water mixing valve which supplies hot water by mixing steam and cold water together for process requirements, etc. (38-Outer Gallery, Grand)

Flexibox, who will show mechanical seals, report that they have successfully adapted their standard mechanical seal-type RR to operate without leakage at exceptionally high temperatures, high pressures and high speeds of shaft rotation. A new addition to the Flexibox range differs from the standard type RR in that it is fitted with a special cooled sleeve. (6-R)

Safety relief valves to be shown by Dewrance & Co. Ltd. are suitable for petroleum liquids, gases and vapours. They are of the full-nozzle, high-lift, high-capacity type and are available with carbon or alloy steel bodies and stainless-steel trim to suit service conditions.

The standard valve includes an eductor tube, the function of which is to allow pressure within the bonnet to be withdrawn into the discharge stream faster than it is possible for it to enter through the guide clearance, thus allowing only the force exerted by the spring to control the valve. The flat-

faced disc is specially designed to eliminate distortion under high-temperature service and thus, the makers point out, permits maximum tightness under all conditions of operation.

Dewrance will also show a selection

of their gauges, for which direct-mounting chemical attachments are available including a corrugated diaphragm which acts as a flexible, pressure-proof wall between the *Dura-gauge* and corrosive liquid. (2-E)

## ENGINEERING AND FABRICATION SERVICES

On view at the Davey, Paxman stand will be details of fabricated steel pressure vessels to Lloyd's A1 requirements, fabricated in a wide variety of metals including stainless steel, *Monel* metal, aluminium and other ferrous and non-ferrous materials. (7-C)

Displays of steel castings made for the chemical and petroleum industry will be featured by K. & L. Steelfounders & Engineers Ltd. One exhibit will be a fluid end cylinder for a duplex double-acting slush pump to be used with an oil-well drilling rig. The casting weighs  $3\frac{1}{2}$  tons and, after machining, is subjected to hydrostatic pressure of 5,250 p.s.i. The material is a special carbon steel. Another exhibit, the hook body, is for oil-well drilling rig hook block assembly. The safe load capacity of this alloy-steel casting is 400,000 lb. The casting weighs  $13\frac{1}{2}$  cwt., and must be completely free from the slightest surface defect.

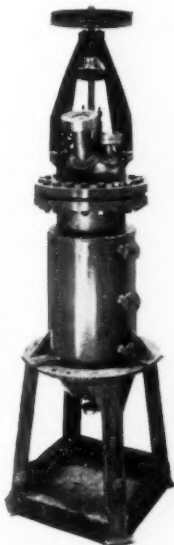
Valve bodies to be shown will include three steel castings: (a) an 8-in. plug valve body weighing 3 cwt.; (b) a 14-in. wedge gate valve body

weighing  $5\frac{1}{2}$  cwt. and (c) a 16-in. valve body weighing 8 cwt.

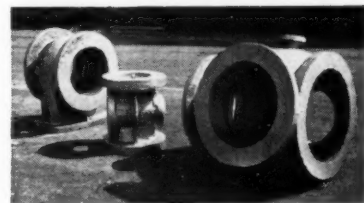
In addition, there will be a miscellaneous collection of cast-steel components for oil-field and refinery use, on show. The company make carbon, low-alloy and high-alloy steel castings to any heat treatment and their range of over 400 machine tools enables K. & L. to supply partially or fully machined castings when required. Among the many steel castings supplied to the chemical and petroleum industries, K. & L. Steelfounders & Engineers Ltd. make steel for heat-exchanger parts, steel headers for distillation and cracking plants, steel valve and cock bodies and parts, furnace tube supports, etc. (2-M)

The Taylor Rustless Fittings Co. Ltd., as specialists in the manufacture of plant and equipment in stainless steel, will have all their exhibits in that metal and they will range in size from a 20-ft.-long tank for a railway wagon and a 14-ft.-high severe-duty reaction vessel to 5-litre laboratory fermenters and laboratory beakers.

Other exhibits the company hope to



Reaction vessel displayed by Taylor Rustless Fittings Co. Ltd.



Castings by K. & L. Steelfounders & Engineers Ltd.



Type 8500 return jumps by Lake & Elliot Ltd.



## ENGINEERING AND FABRICATION SERVICES (continued)

include are examples of items of chemical plant, such as bubble caps and trays and columns; fabricated and manipulated pipework; and an item from a range of jacketed pans. Items of stainless-steel chemical hollow-ware and stainless drums and containers for transport and storage will also appear.

The severe-duty vessel mentioned was fabricated entirely in the company's own shops and has a polished, crevice-free interior. The vessel is also designed to British Standard codes as a severe-duty vessel involving top-quality welding and radiographic inspection, which is also done at the Taylor works. The agitator drive is also of the company's manufacture. (12-F)

G. A. Harvey & Co. (London) Ltd. will include a vacuum/pressure vessel entirely of welded construction, weighing some 23 tons and made from mild-steel plate  $\frac{3}{8}$ -in. thick and heavier. (1-F)

The centre and focal point of the Firth Brown stand will contain a display of six large, coloured transparencies depicting heavy rolling forging of a high-pressure steel drum under the 6,000-ton press, the tapping of an electric furnace, light hammer forging, etc., so grouped as to be visible from all angles, and surmounted by a massed display of bars on which will be a large-sized model of Atlas, the trade mark of Thos. Firth & John Brown Ltd. (1-E)

On the stand of A. J. Riley & Son Ltd. will be shown some examples of the range of plant and equipment which this firm of engineers design, manufacture and supply to the chemical and allied industries. Exhibits will include a heat exchanger, a pressure vessel, stainless-steel mixer, bellows-type expansion joints, and a Hoval steel boiler, complete with oil-firing equipment, forming a self-contained packaged unit.

An extensive display of photographs will give further examples of the company's activities and there will be examples of oil storage tanks, stainless-steel acid storage tanks, mild-steel rubber-lined tanks, Class 1 and Class 2 pressure vessels, columns, mixers, crystallisers, oil heaters and boiler installations.

Other illustrations will display site work being undertaken at various locations. (10-D)

Metal Propellers' exhibits will illustrate their manufactures in stainless steel and other corrosion- and heat-resisting alloys for the petroleum refinery and chemical industries, and will reflect the effect of extensions and plant additions carried out at their Croydon works during the last few years.

Strip lining work carried out on site and in the works will be illustrated by photographs. (11-C)

The Birmingham Battery & Metal Co. Ltd. will be exhibiting a comprehensive range of tubes and plates in copper and copper-based alloys. Prominent on their stand will be aluminium-brass tubes and sheets, copper-nickel-iron tubes and sheets, brass screwing tubes, naval brass plates, bi-metal tubes and welding copper.

The company, which specialises in individually tailored items, reports that seamless tubes can be produced from  $\frac{1}{4}$  up to 24 in. diam. in copper and to 16 in. diam. in brass. Condenser plates and heat-exchanger plates, in standard alloys to British and American Specifications up to the heaviest weights manufactured in Great Britain, are undertaken.

Other examples of this company's products include hot-rolled copper sheets and plates, deoxidised arsenical and non-arsenical, available in large widths and in special shapes according to customers' requirements.

In addition, a range of hot brass stampings such as impellers, etc., of special interest to the chemical and petroleum industries, will be displayed by Guests Brass Stamping Co., a subsidiary undertaking. (4-R)

The main contribution made by Lake & Elliot Ltd. to the chemical and petroleum industries is the manufacture of furnace fittings made under licence from and designed by the W-K-M Manufacturing Co. Inc., U.S.A. These fittings are made under the trade name *Millenium-Key*. They are designed to meet the special design conditions laid down by operating conditions and the materials used are selected to meet these conditions and also the corrosion/erosion characteristics of the raw materials being processed.

The other main function of the company in relation to these industries is the supply of high-quality carbon, alloy and stainless-steel pressure castings, both machined and unmachined, for wellhead, line, relief, safety, control and regulating valves, pumps, heat exchangers and tube supports. (11-D)

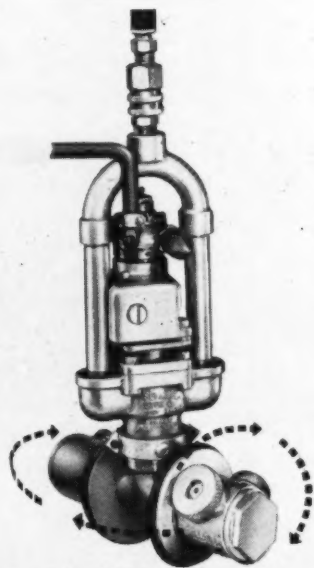
## CLEANING AND MAINTENANCE

Hydraulic jet cleaners, which operate on ordinary plant steam and cold water, will be shown by CP Equipment Ltd. They have no moving parts and produce a jet of very hot, high-pressure water which is supplied by means of a hand lance and one of a range of nozzles to suit differing duties.

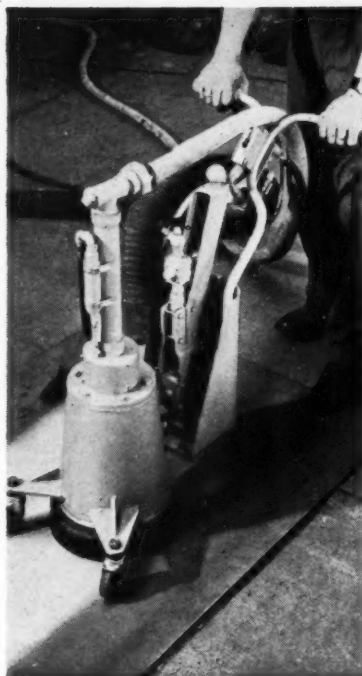
Also on show will be the 1½-in. rotor jet unit which is steam operated and is designed for cleaning totally-enclosed tanks, spray driers, etc., without the need for personnel to enter the interior. The rotating head directs two continuous, high-impact jets which change direction with each rotation. During the cleaning cycle the hot liquid jets move in a spherical path—hydraulically scrubbing the entire inner surface of the tank or vessel. (30-Outer Gallery, National)

A new design of compressed-air-driven surface scaling and chipping machine, suitable for dealing with all types of external surfaces, such as chemical vats, tanker decks, etc., will be shown along with the complete range of *Lark* compressed-air and electrically-driven tube cleaners and accessories such as cutter heads, drills, etc. The exhibitors are Industrial Descaling Tools Ltd., the selling organisation for the manufacturers, H. Williams & Son Ltd., of Lark Works, St. Albans.

Both straight and curved tubes from



Sellers' Rotor Jet' cleaner to be shown by C.P. Equipment Ltd.



'Vacu-Blast' high-production gun for removal of millscale, etc., from large areas of flat plate.

$\frac{1}{8}$  to 16 in. i.d. are within the range of *Lark* products, and of particular interest are the outside-mounted machines with hollow, high-tensile-steel driving shafts, tungsten carbide-tipped and high-speed drills recommended for the removal of heavy deposits from small-bore straight tubes. (20-Outer Gallery, Grand)

A new line being exhibited by Consolidated Pneumatic is a range of *Lagonda* tube-cleaning equipment, now being manufactured by the company under licence. This will embrace a series of air-powered tube-cleaning motors used with straight and curved tubes ranging from  $\frac{1}{8}$  to over 6 in. in diameter. (6-D and 8-E)

A new range of industrial floor-scrubbing, polishing and drying machines will be shown by the British Vacuum Cleaner & Engineering Co. Ltd., including the *Hedgehog*, designed for the heavy-duty action of removing compacted oil and grease. The breaking down of the compact is executed by means of special spring-steel-filled brushes. The *Otter* is primarily designed as a wet scrubber, but can also be used as a dry scrubber or floor polisher. It is available for either mains or battery operation. (34-Outer Gallery, Grand)

## WELDING AND SHOT-BLASTING

Electrodes and equipment used in arc welding processes will be exhibited by Quasi-Arc Ltd. On the manual welding side, the firm will be demonstrating a number of electrodes which are of particular interest to the oil and chemical industries.

The new *Lynx* equipment for shielded inert gas metal arc welding on non-ferrous alloys, corrosion- and heat-resisting steels and mild steel, will also be demonstrated. This equipment has been designed with lightness and portability in mind, and incorporates remote control of welding current and wire feed. Welding is carried out with a light water-cooled pistol or, on sites where water cooling is difficult to arrange, with an air-cooled pistol. (9-E)

On the Murex stand will be the new *Fastex* 100 hand-welding electrode which has been specially developed for the rapid welding of pipe joints *in situ* using the 'stovepipe' or vertical downwards technique. (8-J)

Vacu-Blast Ltd. will be exhibiting three of their range of mobile dust-free shot-blast machines. The *Major*, with its high-production gun for millscale removal from large areas of flat plate, together with the *Medium* and *Junior* machines, will be available for demonstration throughout the period of the exhibition. It is significant that shot-blasting operations will be carried out in a public exhibition hall without recourse to protective clothing or room enclosures. Besides these exhibits the display will include a range of attachments for plate edge and pipe cleaning and blast cabinets for use with Vacu-Blast machines.

The *Vacu-Blast* machine incorporates a closed-circuit pressure-vacuum system for the supply of abrasive to the work surface and recovery of spent abrasive, dust and debris. The machine automatically separates and cleans the abrasive, the dust and debris being abstracted from the air stream, and the finest particles of dust are finally filtered from the exhausted air. Machines are in use on many of the plant installations under the aegis of the U.K.A.E. and the C.E.A., including Dounreay, Chapelcross, Berkeley, Bradwell, Aldermaston and Harwell. Several leading contractors to the Authority also employ the process in their works on prefabricated sections. Present applications include the cleaning of heat exchangers, reactor vessels, scale re-

moval from heavy plate, weld preparation and de-slagging and preparation for metal spraying. Besides the important part played in new construction, *Vacu-Blast* is claimed to be very suitable for general plant maintenance.

Internal cleaning of pipes has long been recognised as a difficult if not insoluble problem, but the *Vacu-Blast* system has successfully been adapted to this purpose. It is now possible to provide positive cleaning attachments for tube bores of any size from  $\frac{1}{8}$  in. upwards. Results obtained in industry show that the *Vacu-Blast* cleaning is far superior to other methods such as acid pickling and rotary descaling. The method is equally applicable to straight or formed pipes.

Besides its use on normal ferrous metals, *Vacu-Blast* is claimed to be equally successful on alloy steels, aluminium alloys, *Nimonic* alloys, yellow metal alloys, *Durestos* material for metal spraying and resin-bonded lamina for rubber coating. (8-M)

## INSTRUMENTATION

Taylor Controls Ltd. will be showing their new *Transcope* recorder and also the new potentiometer transmitter, both described in *CHEMICAL & PROCESS ENGINEERING* in April (page 138).

In conjunction with the *Transcope* recorder, there is the *Transcope* controller, which is a non-indicating miniature pneumatic instrument, utilising metallic bellows as pressure receivers. According to the makers, it is characterised by easy maintenance, simple adjustment procedures, small ambient temperature error, negligible drift, ease of change of control form, improved accuracy of dial calibration and compatibility with the pneumatic receiver to provide controller adjustments from the front of the receiver. (7-H)

Dial gauges for continuous measurement of low gas and vapour pressures will be a feature by Edwards High Vacuum. A sealed metal capsule is employed as a pressure-sensitive element and the gauges are accurate to within  $2\frac{1}{2}\%$  of full-scale deflection. The *Speedivac* model LT6 leak detector is a new instrument based on the hydrogen Pirani method. A special balancing and amplification system enables leakage of  $10^{-3}$  lusec to be detected on a robust milliammeter, thus dispensing with the sensitively

## INSTRUMENTATION (continued)

suspended galvanometers hitherto employed. (23-*Inner Gallery, Grand*)

Reyrolle are showing a range of industrial and flameproof switchgear including a two-panel four-circuit contactor switchboard of flameproof construction with a remote control pedestal designed specially for controlling plant in oil refineries and chemical factories, in which fire hazards exist. (2-Q)

Exhibits of control gear by G.E.C. will include a motor control centre as supplied for use in refineries. The cubicles comprising the control centre will accommodate a wide range of starters, reversers, switch fuses, etc. Individual control units are built on the plug-in principle, thus permitting the speedy replacement required in large plants where continuity of operation is essential. The motor control centres can be arranged for sequence interlocking. (6-Q)

The new, mercury-less, bellows-type, diaphragm flow meter which measures a range of differential pressures from 20 to 200 in. of water at static pressures up to 2,000 p.s.i. will be shown by Foxboro-Yoxall. (2-P)

As well as their electric surface heaters, Isopad Ltd. will have a representative selection of control equipment, from purely manual to fully automatic, to provide for uniform temperature or thermal cycling under any process conditions. Used in conjunction with electric surface heaters, such controls open the way towards automation of thermal processes. (7-K)

In addition to a selection of individual starters and control stations, the main industrial exhibit of the Belmos Co. is a medium-voltage control board which comprises pillars and multi-tier cubicles housing 200 and 600-amp. circuit breakers and contactor starters for a.c. motors up to 200 h.p. (10-F)

An interesting example shown of one of the many applications of the *Commander* range of instruments, on the George Kent stand, consists of four instruments, all perfectly standard, which comprise a mass-flow computing installation. A differential pressure instrument measures the head across an orifice, this measurement being corrected by means of two further instruments, one for pressure and one for temperature, according to the

prevailing conditions, a final reading in mass-flow rate being given on a *Commander* receiver. (10-G)

On the Dewrance stand will be an exhibit of a pneumatic transmission system for pressure indication. It measures pressures up to 20,000 p.s.i., offers the advantages of operating on low-pressure air over distances up to 1,000 ft., and can easily be installed with small-diameter piping.

In the electronic process control

system to be shown by Dewrance the *Microsen* balance is the major functional element of the transmission and control instruments and is a simple electro-mechanical servo system operating on the force-balance principle. It produces a high-level d.c. signal which is unaffected by electrical or ambient conditions. A typical pressure loop and temperature loop respectively will be diagrammatically displayed, together with associated equipment. (2-E)

## PROCESS EQUIPMENT

In addition to the plant mentioned under 'Distillation,' T. Giusti & Son will exhibit stainless-steel vessels, heat exchangers and equipment having special features. The equipment on show will be representative of products for both the chemical and petroleum industries. A section of the stand will be devoted to the exhibition of the industrial separators and clarifiers made by Westfalia Separator A.G., for whom Giusti are agents in the U.K. (5-N)

The L. A. Mitchell stand will show that, in the chemical process equipment field, in addition to general process reaction vessels, the company specialise in grease kettles, esterification reaction kettles, air flotation effluent treatment plants and bulk storage installations for chemical liquids and solutions. (8-C)

In the new glass-enamelled reactor to be shown by T. & C. Clark two features are the use of a bolted-on, mild-steel steam jacket and the provision of four large openings in the cast-iron cover. Impeller-type agitators with adjustable baffles are employed in this reactor, but modification of this method can be made if required. (7-M)

Paxman's will also show models of their shell and 'K' type water tube boilers. The 'K' boiler is available as a package factory-assembled self-contained unit, as also are the smaller ultrasonic and economic shell boilers. The larger water tube and shell boilers are designed for the more orthodox factory installation. (7-C)

Equipment to be displayed on the Cannon (CP) Ltd. stand includes a glass - enamelled mild - steel steam-jacketed pan of 50-gal. capacity, suitable for working steam pressures up

to 75 p.s.i.; this vessel is fitted with an enamelled cast-iron bottom outlet valve with *Fluon* seating. A glass-enamelled cast-iron steam-jacketed pan with bottom outlet of 50-gal. working capacity, of similar design to the British Standard pan of that size, will be another exhibit, while there will also be a range of 20-gal. glass-enamelled cast-iron digestors, un-jacketed, steam-jacketed and electrically heated. A large glass-enamelled, mild-steel, anchor-type agitator of tubular construction will be another Cannon feature.

Various glass-enamelled cast-iron agitators and thermometer pockets will also appear on this stand as will certain small equipment suitable for use in laboratories. (8-G)

A Kestner-Johnson metallic nitrate pilot plant will be shown by Kestner Engineering & Evaporator Co. as an example of the company's process work. It is hoped to have this working and, as it is made mainly of glass, it will be possible to see the dissolving of the metal and the formation of the brown nitrous fumes in the reactor. Subsequently these are scrubbed and the final effluent gas leaves the plant as completely harmless oxygen. The process is used for the production of uranium, silver, nickel and bismuth nitrate in the United Kingdom. (10-E)

Jacketed reaction vessels to be shown by Metal Propellers will include vessels of 50 gal., 190 gal. and 350 gal. capacity in stainless steel and nickel. (11-C)

General-purpose, standard pans of reinforced resin will be shown by Mendip (Chemical Engineering) Ltd. The pans, which are of 300, 500 and 700 litres capacity, are mounted on an integral skirt. (26-*Outer Gallery, National*)



## MATERIALS OF CONSTRUCTION

A display of components in titanium on the Imperial Chemical Industries Ltd. stand should reveal the latest applications of this metal in chemical plant. The stand will feature large, lined vessels and a variety of fabricated products such as valves and valve plates, gas nozzles, agitators, anodising jigs and complete heat-exchange units. Examples of I.C.I. Kynal aluminium and aluminium-alloy products include fabricated pipework, vessels, heat exchangers and wrought forms such as busbar, heat-transfer sheets, structural extrusions, profiled building sheets and treadplate.

Of particular interest to heat-exchange engineers are I.C.I. *Integron* finned tubing in steel, aluminium and bi-metal, and *Tube-in-Strip* heat-transfer material. The company also show wrought forms of new metals—zirconium, niobium and tantalum—developed for nuclear engineering but equally promising as materials for plant handling corrosive chemicals. (9-G)

Corrosion-resistant equipment manufactured from impervious graphite will be shown by British Acheson Electrodes Ltd. (see under 'Heat Transfer') and the display will include various parts such as tube sheets for tube and shell heat exchangers, valves, steam jets, etc. (13-J)

Powell Duffryn Carbon Products Ltd. will also show graphite heat-exchange equipment, described elsewhere, while another working exhibit will be the apparatus designed to demonstrate the leading features of the company's graphite bursting discs. Carbon-lined, two-stage, steam-operated ejectors and carbon-lined water-operated ejectors will also be featured. (3-O)

Murex Ltd. will be exhibiting articles fabricated in pure tungsten, molybdenum, tantalum, niobium and zirconium. These will include tantalum bayonet heaters for the petroleum industry and also tantalum absorption columns for hydrochloric acid. A high-temperature vacuum furnace having tungsten heater element and molybdenum radiation screens will also be demonstrated.

Niobium tube, sheet and wire will be available, together with corrosion-resistant items, fabricated in zirconium, and it will be explained that crucibles can now be fabricated in pure tungsten by spinning, while the range of pure molybdenum vessels is being extended considerably.

Sintered permanent magnets and *Sincomax* magnets are being displayed, together with the instruments of which they form a vital part. These magnets are of particular value where a small magnet of high magnetic and physical stability is required. A selective range of *Prolite* cemented tungsten carbide tools, tips, dies and wear-resisting parts will be displayed, together with the *Prolite Futurmill* and other carbide milling cutters. (8-I)

On the Kestner stand, numerous items of chemical plant will illustrate the applications of *Keebush* plastic and *Keeglas*, the company's latest type of glass laminate material. (10-E)

High-frequency techniques and the control of the energy generated by new processes have widened the field of the ceramic engineer. Wm. Boulton Ltd. will display plant covering the whole field of technical ceramics, including machinery for processes in the nuclear power and jet propulsion field. (14-Inner Gallery, Grand)

An ingenious working model which demonstrates some of the industrial uses of porous ceramics will be displayed on the stand of Doulton Industrial Porcelains Ltd. The processes involved in gas diffusion, removing suspended solids from liquids and filtering compressed air will all be shown on the model.

The company will also display a range of ceramic products including porous ceramics, hard porcelain grinding materials and acid-resisting stoneware. Actual units of chemical plant will embody acid-resisting stoneware and thermal shock-resisting stoneware, which indicate some of the wide possible uses of ceramic products. (3-Q)

In addition to their submerged-combustion evaporating exhibit, Nordac Ltd. will have specimens of rubber- and lead-lined equipment on their stand. A 25-in. square filter plate and frame will be exhibited, covered with a special composite layer of hard and soft rubber. By this method a very high degree of adhesion is obtained to the metal by the hard rubber, and the outer layer of soft rubber is of a tough quality which is suitable for rough usage and can be repaired should any mechanical damage take place.

Another exhibit here will be a lead anode constructed of expanded lead, which gives the maximum throwing surface for electro-deposition. Further

items will consist of rubber- and *Vulcoferran*-lined fittings and specimens of homogeneously lead-covered equipment. (5a-M)

Various items of plant and equipment illustrating the uses of reinforced resins in the chemical, petroleum and allied industries will be shown by Mendip (Chemical Engineering) Ltd. See under 'Filtration,' 'Fluid Handling' and 'Process Equipment.' (26-Outer Gallery, National)

In addition to their cast-iron and stainless-steel valves, Wynn (Valves) Ltd. intend to show some of the other materials of manufacture. There will be bronze and aluminium valves, the latter with nylon lining; other types of linings will include soft rubber and lead. There will also be specimens of diaphragms to show the many different materials available, and examples of the newest of these and their construction. (12-K)

Prominent in the post-war developments of J. Stone & Company (Charlton) Ltd. has been a new series of copper alloys based on copper, manganese and aluminium. They are sold under the brand name *Superston*. The exhibit is to be devoted to *Superston* castings and wrought products such as have been supplied to the oil, chemical and marine industries. Castings for pumps and wrought products for heat exchangers are typical, and examples of welds will also be shown. (18-Inner Gallery, National)

Stainless, heat- and corrosion-resisting steels will be shown by Firth-Vickers Stainless Steels. (4-D)

Johnson, Matthey will show a number of rhodium-platinum thermocouples and also examples of the use of silver for the protection of constructional materials employed in the chemical process industries—for instance, steel and copper. The corrosion resistance of silver makes it useful as linings for reactors, condensers, evaporators and other types of plant. (11-H)

Fibreglass Ltd. will feature rigid sections for pipe insulation, wired mattress and resin-bonded for boiler insulation, high efficiency filtration media, and coalescing cartridges.

Comparison will also be made between unwrapped and tissue-wrapped pipes for protection against corrosion. (13-Inner Gallery, National)

## MISCELLANEOUS OTHER EXHIBITS

The exhibit of Peabody Ltd. will include scrubbers, coolers and absorbers, combustion equipment and air heaters.

Peabody gas scrubbers, which embody impingement baffle plates and employ no moving parts, are claimed to be economical in the use of water and power and to offer exceptionally high efficiencies. To demonstrate the principle employed, a working model constructed in transparent materials will be on view. Information and practical demonstration will be available on the application of these scrubbers to dust removal, gas cleaning and cooling, absorption and stripping soluble components, and combating atmospheric pollution. (30-*Inner Gallery, Grand*)

Russell Constructions Ltd. will demonstrate some recent developments in sieving and straining equipment. The application of high-frequency gyratory vibration forms the basis of operation of these machines. One, a high-speed strainer, has a screen area of less than  $2\frac{1}{2}$  sq. ft. and can strain materials at an output of up to 1,200 gal./hr., and can function with the finest screens. A new and improved version of the Russell separator has a capacity of up to 15,000 gal./hr. It is self-cleaning and automatically rejects oversize material. This machine has been very successfully applied to the straining of curd particles from whey liquor, palm kernel oil, raw sugar juice and milk of lime straining in the sugar beet industry. The straining of cocoa mass and cocoa powder and various starch liquors, and coconut oil, are further examples of the machine's versatility.

An improved *Cascade* sieving machine will also be shown. This unit is ideal for sieving operations, yielding outputs of up to 6 tons/hr. It is silent in operation and is completely dust-proof. Fine nylon mesh is used as the screening element in this unit.

It has been found that, at a very high speed of gyration, quite phenomenal outputs can be obtained in the sieving and straining process, but that these effects only take place at highly critical frequencies. To meet this requirement, Russell are exhibiting a new variable-speed machine which demonstrates this with remarkable effect. (3-*Inner Gallery, Grand*)

Some entirely new lines of compressed air plant and equipment, some new versions of established products

and a full selection of power tools and compressors will be displayed by Consolidated Pneumatic Tool Co. Ltd.

The centrepiece of the new equipment section will be a machine which will be representative of a new range of stationary compressors of horizontal, balance-opposed design and are stated to be particularly suitable for building up for a wide range of service. In this respect, the crankcase and running gear can be fitted with different sizes and numbers of cylinders to give outputs of up to 5,000 cu.ft./min. F.A.D. or pressures up to 3,000 p.s.i. The two-cylinder arrangement is used for horse powers up to 350 and four cylinders for horse powers between 350 and 700. (6-D, 8-E)

Ruston & Hornsby are displaying their 'TA' 750 to 1,000-kw. gas turbine, also their new and smaller gas turbine, the Mark 'TE.' The company predict that this 430-b.h.p. machine will prove popular with oil companies for small, portable alternator sets, and for oil pump, water pump and compressor drive. (11-A)

Winn & Coales specialise in anti-corrosion products, and a comparatively recent development has been the lamination of the soft grease-type wrapping with a film of PVC, providing thus in a single cold-applied tape the undisputed advantages of the petrolatum base together with a tough, dry exterior. (13-A)

A new range of hydraulic jacks of 10 to 30 tons capacity is to be exhibited by Felco Hoists. (10-C)

A Tirfor Ltd. exhibit will be a lifting and pulling machine with a lifting capacity (S.W.L.) of 1 ton and a pulling effort of 30 cwt. The machine is entirely portable, hand operated, and weighs approximately 39 lb. (42-*Outer Gallery, Grand*)

Three new machines for the plastics industry will appear on Burtonwood Engineering Co.'s stand. One is a 60-mm. extruder for the production of insulated wire and cables, flexible and rigid pipes and tubes, and profile sections in thermoplastic materials. The two other machines are concerned with the reduction or preparation of plastic materials to render them suitable for further processing into a finished product, by extrusion, injection moulding, etc. One, the 7-in. stair-step dicer, produces regular cubes

of plastic material from a 7-in. strip without at the same time producing 'fines' or 'longs.' (13-H)

The British Chemical Plant Manufacturers Association will have a stand which will act as an information bureau in respect of chemical plant exhibits. (3-F)

The C.B.M.P.E. stand will act in a similar capacity on the petroleum engineering side. (4-E)

A special feature on the Whessoe stand will be the insulated spheres and tanks recently devised for the low-temperature storage of liquefied gases, the display including a full-scale sphere for the bulk storage of liquid gases and a model of a methane storage tank. (3-E)

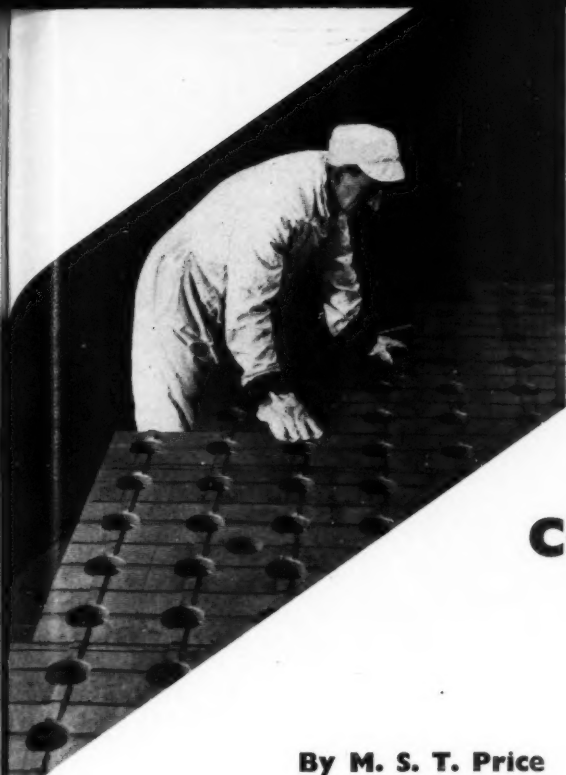
The latest portable foam unit for oil tank farms to be shown by Pyrene is a telescopic foam tower which is designed to provide automatic elevation by foam pressure and ensures the rapid application of foam to tank tops up to a height of 70 ft. It is made of light aluminium alloy and is easily transportable. (18-*Outer Gallery, Grand*)

Fire-fighting equipment on the stand of George Angus & Co. Ltd. will include hose and extinguishers, particularly those which have an application for the protection of chemical and petroleum installations. *Flame Fighter* fire hose is a recent introduction, being composed entirely of all-synthetic fibre yarns.

The complete standard range of Angus dry powder chemical fire extinguishers will be on view, ranging from the 5-lb.-capacity transport model to the 350-lb.-capacity model, the latter mounted on wheels and fitted with special four-way control nozzle. The 350-lb. machine is used for protecting oil fields and similar installations against fire hazards. The 5-lb. and 350-lb. models are the two most recent additions to the Angus range, and have not been exhibited before. (27-*Inner Gallery, Grand*)

The Fraser pin granulator is a novel machine, primarily intended for use as a pre-granulator, and developed by W. J. Fraser in co-operation with Scottish Agricultural Industries Ltd.

It will be exhibited as an example of Fraser's range of granulation and fertiliser manufacturing plant. (2-G)



*The technology of the great variety of manufactured carbon and graphite solids is often regarded as a 'black art.' In the last decade, however, owing mainly to the stimulus of atomic energy, considerable information has been published. This article reviews the progress that has been made in applying carbon and graphite to industrial purposes.*

## Carbon and Graphite in Industry

By M. S. T. Price

**W**ITHIN the last three years there have been three large-scale conferences wholly devoted to carbon and graphite, two at Buffalo in the U.S.A. and the third held by the Society of Chemical Industry in London. A further aspect of the considerable interest in the subject is the growing technical effort. In Britain alone some 200 scientists are at present engaged on research and development work into all aspects of carbon technology.

The conventional manufacturing process has evolved over the last 150 years. Powdered filler, such as ground petroleum coke or carbon black, is mixed with a fusible hydrocarbon binder (coal tar or coal-tar pitch) and then shaped either by extrusion or moulding. The formed 'green' article is then baked to a maximum temperature between 650 and 1,300°C. in supporting powder which also protects the stock from oxidation. During baking the binder decomposes with considerable gas evolution and shrinkage, giving a 50 to 80% yield of pitch coke. To mitigate these changes in the binder, the baking cycle must be very extended, the total turn-round time often being three weeks. The baked material is termed *carbon*. *Graphite* (Table 1) is obtained by repacking and reheating the baked stock to temperatures between 2,500 and 3,000°C. in special electrical resistance furnaces where the blocks themselves carry current, the operation being called *graphitising*.

Recent developments in processing include the use of self-bonding raw materials such as uncalcined petroleum, coke and coal, impregnants and coatings to improve oxidation resistance and reduce permeability to gases, and attempts to speed up the baking process. In this latter connection, it has recently been revealed that the

National Carbon Co. has installed plant to exploit the so-called Hedges process which reduces the baking time to about 8 min.<sup>1</sup>

The properties of carbon and graphite depend in a complicated manner on both the coarse and the fine structure. The coarse structure of graphite, as is evident from a polished section, consists essentially of porous filler particles cemented together with extremely porous binder coke. The grain boundaries of the filler are evident at all stages of manufacture, persisting even in materials heated to 3,000°C. It is inherent in the manufacturing process that all normal carbons and graphites are porous and permeable, the porosity deriving chiefly from binder decomposition. Although the theoretical crystal density of graphite is 2.26 g./c.c., the bulk density of manufactured graphite is usually in the range 1.55 to 1.80 g./c.c. Being derived from highly porous lump, the particles of petroleum coke produced during crushing and grinding are angular; in consequence, alignment takes place during forming and the resultant carbon is anisotropic.

The fine structure of graphite has been extensively studied by x-ray diffraction techniques. The graphite

**Table 1. Typical Room Temperature Properties of Graphite made from Pitch-bonded Petroleum Coke**

Resistivity (ohm-in. $\times 10^{-4}$ )	4
Strength (p.s.i.):	
Tensile	800
Transverse	2,000
Compressive	4,000
Permeability (millidarcys)	2
Bulk thermal expansion coefficient—mean over range 0 to 250°C. ( $\times 10^{-5}/^{\circ}\text{C.}$ )	1
Thermal conductivity (c.g.s. units)	0.30
Hardness (Shore scleroscope)	30
Apparent density (g./c.c.)	1.60
Real (helium) density (g./c.c.)	2.15

Above: Part of the graphite structure in the first of the Calder Hall nuclear power reactors.

[Copyright U.K.A.E.A.]



crystal lattice has a layer structure and somewhat similar, though considerably smaller, crystals are found in baked carbons. On heat-treating baked carbon to increasingly higher temperatures, there is both lateral growth of the layers at the expense of adjacent smaller crystallites and an increase in the number of layers. Such crystal growth can be inhibited in several ways, but it depends primarily on the nature of the raw materials. Important aspects of the fine structure, which have not as yet been investigated in sufficient detail, relate to the arrangement and interaction of crystallites within a particle.

Industrially, the main ways of controlling the coarse and the fine structure are in the selection of raw materials, their size distributions, the method of forming and the maximum heat-treatment temperature. In this manner, an extremely wide variety of properties is possible. The main properties of carbon and graphite which lead to the wide range of applications mentioned in this review are:

- (1) High thermal conductivity (of graphite).
- (2) Chemical inertness except to oxidising agents.
- (3) Low bulk thermal expansion.
- (4) Reasonable electrical conductivity (resistivity variable over the range 0.00025 to 0.1 ohm-in.).
- (5) Reasonable strength, particularly in compression, generally higher for a given composition at the carbon stage. Significant increase of strength with temperature up to about 2,600°C.
- (6) Good nuclear properties.
- (7) Low coefficient of friction of graphite under normal conditions of lubrication ( $\mu$  0.10 to 0.20).
- (8) Low vapour pressure up to extremely high temperatures ( $10^{-4}$  mm. Hg at 2,300°C.).
- (9) Gaseous products formed on oxidation preventing surface blanketing in electrical contact applications.
- (10) Easily worked, as graphite, with normal steel- or woodworking tools. Carbon, being much harder, requires diamond or silicon carbide tools.

### Electrical applications

In most electric motors and generators the current is fed to or from the rotating part by means of a contact electrode, termed a *brush*. The requirements of a brush are an onerous combination of electrical, mechanical and refractory properties. It must, for example, maintain a uniform contact at all times with low frictional and electrical losses. At the same time the wear rate of the brush and the rotating part must be extremely low. Almost the complete range of brush applications is met by carbon, graphite or metal-graphite materials. The great variety of electrical machines, each with a unique set of operating conditions, has forced the development of a large number of brush grades, compositions, shapes and sizes (Fig. 1). Since at least 80% of modern brush applications demand graphitised materials, it is to be expected that the main advances are in this field. Developments over the last 20 years have recently been summarised by Vaughan.<sup>2</sup> For large d.c. machines it has been necessary to develop materials which are extremely porous (and therefore highly damped mechanically) but which are nevertheless sufficiently well bonded not to give rapid brush wear. On the other hand, for electric traction applications, to stand up to the rugged operating conditions, tough, dense, graphitised grades have been required, sometimes impregnated with synthetic resins.

An interesting and somewhat unexpected problem was the devastating wear of brushes in high-flying aircraft first encountered during the last war. Normally the friction

of a brush running on a slip ring or commutator is low, there being boundary lubrication from adsorbed films provided and maintained by the water vapour and oxygen present in the atmosphere. Under high altitude conditions (e.g. partial pressure of water less than 3 mm. Hg) the adsorbed films are not maintained, the coefficient of friction rises and the wear rate becomes catastrophic. There have been many attempted solutions of the problem, as is shown by the extensive patent literature. Hygroscopic materials or oxygen donors have been incorporated in the brush in an endeavour to maintain the adsorbed film. Alternatively, replacement with a less atmosphere-sensitive film has been attempted by incorporation of sulphur or halide-containing materials. More recently auxiliary lubricants such as PTFE or molybdenum disulphide have been exploited, often in the form of plugs in the running face of the brush.

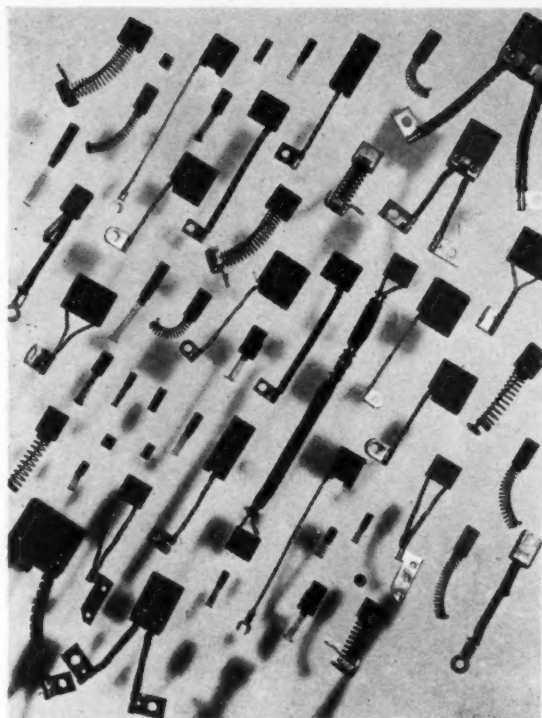
Other electrical applications are legion and include such a diverse range as carbon pile variable resistors, graphite thermionic valve anodes, arc carbons for cinema projection and spectroscopy and metal-carbon trolleybus collectors.

### Electrolytic applications

Carbon anodes and cathodes are employed in the Hall-Héroult process for the production of aluminium by the electrolysis at about 950°C. of alumina dissolved in fused cryolite.<sup>3</sup> Since oxygen is liberated at the anode, the consumption is high, some 0.5 to 0.7 tons of carbon being required for every ton of aluminium. Anode quality is therefore an important aspect of the cost of production. For this reason an electrode manufacturing unit is an integral part of a reduction plant. Some anode and cathode blocks are made by conventional forming and baking processes from calcined petroleum coke, pitch coke or low ash coal coke bonded with coal-tar pitch. The most successful innovation in the Hall-Héroult process has been the introduction of the Soderberg self-baking anode. In the Soderberg electrode, a carbonaceous paste (somewhat similar to, but more fluid than, that used to make prebaked anode blocks) is periodically fed into a thin metal casing held above the furnace. As the anode is consumed the paste flows down into the furnace and is gradually baked into a solid carbon anode. Compared with prebaked anodes, Soderberg electrodes show a lower electrode cost, are not restricted for size and allow better fume extraction. By using Soderberg anodes and a carbon paste for the cathode lining, a considerable amount of mechanisation is being introduced in the new plant at Baie Comeau.<sup>4</sup>

Graphite plate anodes play a vital part in the electrolysis of brine, the basic process in the vast chlorine and alkali industry. Consumption varies between 6 and 25 lb./ton of chlorine. Graphite anodes are also used in the Downs process for the production of sodium metal and chlorine by electrolysis at about 590°C. of a fused sodium chloride-calcium chloride eutectic mixture. A composite cylindrical anode is usually specially fabricated and the graphite consumption is 35 to 42 lb./ton of sodium.<sup>5</sup>

Another fused salt application is the manufacture of fluorine where baked carbon anodes are used in the electrolysis of potassium fluoride dissolved in anhydrous hydrogen fluoride at 75 to 100°C. One difficulty with such electrodes is that there is a tendency for the current to fall away quite suddenly. This effect is usually cured by changing over to nickel anodes for a short period. Graphite electrodes are rarely used, since they swell and disintegrate if the hydrogen fluoride concentration is above a certain critical value. Opinions vary concerning the type of hard carbon to be used as anode material. In certain cases it is pitch-

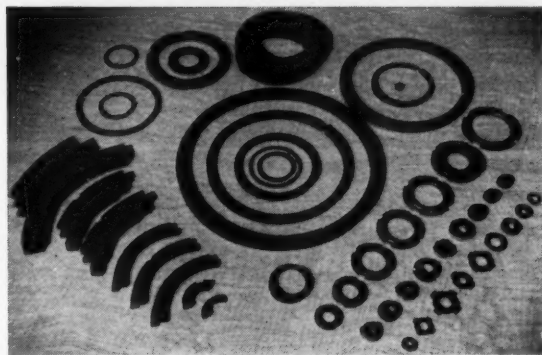


impregnated and rebaked, whilst in others impregnation with molten copper is preferred.

This section should not be concluded without reference to the many other electrolytic applications such as carbon positive poles in dry batteries, graphite anodes for impressed-current cathodic protection and electrodes for cells producing potassium hydroxide, magnesium and lithium.<sup>6</sup>

### Electrothermal applications

Because of excellent resistance to thermal shock (deriving from low thermal expansion and high thermal conductivity), combined with reasonable electrical conductivity and good mechanical strength at temperature, carbon and graphite electrodes are used widely in electrothermal processes. In steel melting, for example, three-phase, direct-arc furnaces are employed, heat being generated in the three arcs between the electrode tips and the earthed bath of metal. The electric arc furnace is particularly useful for making stainless, heat-resisting and alloy steels because of the much closer control possible compared with the open-hearth type. Provided that the electrodes are of adequate strength, the main requirement is that the electrical conductivity shall be as high as possible. However, care must also be taken during manufacture in the selection of the filler coke to obtain low bulk thermal expansion. The trend towards larger furnaces has favoured the use of graphite as opposed to carbon electrodes, particularly because of their greater current-carrying capacity. Electrodes, supplied in 6-ft. lengths, are joined by either parallel-sided or double conical threaded nipples. It is essential to prevent overheating at the joints with consequent surface disintegration and 'necking.' This and other factors influencing the consumption of electrodes have been extensively studied by the British Iron and Steel Research Association.<sup>7</sup>



[Courtesy: Morgan Crucible Co. Ltd.]

Fig. 1 (left). A selection of 'Morganite' carbon brushes.

Fig. 2 (above). A small selection of 'Morganite' piston, gland and sealing rings.

### Mechanical

The self-lubricating properties of graphite make it an excellent material for many bearing applications, particularly where ordinary lubrication is rendered difficult or impossible, due to high operating temperatures, corrosive conditions, or the need to eliminate contamination, as in food machinery. A wide range of mix compositions is employed and impregnants such as waxes, oils, resins, metals and alloys are used to improve performance. A composition disclosed by the author for use in automobile clutch release bearings comprised three parts (by weight) coke, two parts Ceylon natural graphite and three parts hard pitch.<sup>8</sup>

For continuous dry operation the wear rate is kept at a low value by restricting the loading per unit area ( $P$  in p.s.i.), the peripheral speed ( $V$  in ft./min.) and their product  $PV$ . In Britain it is usually recommended that the  $PV$  should not exceed 550 for plain carbon and graphite and 1,500 for metal-impregnated grades. In the United States considerably higher  $PV$  values have been recommended.<sup>9</sup> Typical arduous applications of metal-carbons are the large-diameter chain-grate stoker bearings where with loads up to 350 p.s.i. at high temperatures the wear rate is only 0.002 in./yr.<sup>10</sup>

Under submerged conditions the  $PV$  can usually be increased seven to ten times above the dry running value and, with full fluid film conditions, values in excess of 1,000,000 are possible.<sup>11</sup>

By far the largest single field of application of mechanical carbons is for shaft or face sealing of fluids (Fig. 2). For example, many automobile circulating water pumps employ carbon rings to which special rubber cups are bonded to complete the seal. Further, carbon or graphite glands are used to prevent leakage in steam turbines. Since the shaft diameters are large, the rings are generally made as butt-jointing segments held in place by a garter spring. Under operating conditions the clearance between the shaft and the ring is arranged to be very small. Carbon and graphite are also used for piston rings in otherwise unlubricated compressors and pumps (e.g. for pumping beer) and many small rotary pumps use spring-loaded carbon vanes for sealing. This latter application demands a very fine textured material with a transverse breaking strength generally in excess of 7,000 p.s.i.

## Refractory carbon and graphite

In a non-oxidising atmosphere, carbon and graphite materials are almost unrivalled as high-temperature refractories, particularly above 1,500°C. Even at lower temperatures, general chemical inertness including non-wetting behaviour with most liquid metals and also thermal stability lead to a range of applications.

In Germany, owing mainly to the use of low-grade native ores, almost all blast furnaces are now lined with carbon bricks. Acceptance of the practice in Britain and the United States has been slower. Experience at the Appleby-Frodingham plant of the United Steel Cos. Ltd. has been reported in detail.<sup>12</sup> In an all-carbon blast furnace the parts which are most susceptible to attack are the hearth floor and the upper part of the stack. The loss of hearth is generally considered to be due to graphitisation of the carbon bricks, but there may be several corrosion mechanisms involved.<sup>13</sup> Graphite materials are also used in steelworks for ingot moulds, ingot mould liners, stool inserts, runners, etc.

Carbon bricks form the floor of graphite electrode arc furnaces for the manufacture of elemental phosphorus and carbon and graphite are also used in other processes in the phosphorus industry. The Tennessee Valley Authority, for example, employs graphite-lined combustion chambers in the preparation of phosphoric acid, whilst in the manufacture of tricalcium phosphate fertiliser the furnace hearth is made of graphite.<sup>14</sup>

Graphite resistor furnaces are used for special high-temperature applications up to at least 3,100°C. Most designs have been for laboratory furnaces and parallel-sided small-diameter tube resistors have sufficed. Recently, however, a fairly large chamber-type furnace as installed at A.E.R.E., Harwell (Fig. 3), has been described.<sup>15</sup> Graphite is also used for the susceptor in high-temperature, high-frequency furnaces.

The ease with which a good surface finish may be obtained has led to the use of graphite as a mould and die material in hot pressing of refractory hard metals, ceramic oxides, cemented carbides and bonded diamond tools and the semi-continuous casting of non-ferrous metals.<sup>16</sup> The fine-grained graphites used in such applications have a transverse breaking strength of some 4,000 p.s.i. at room temperature. Stronger graphites have, however, been developed in the last few years and materials with a strength of 10,000 p.s.i. are now in regular production in reasonably large sections.

Graphite materials have been examined for possible use in rockets. Smiley,<sup>17</sup> for instance, has reported that zirconium-impregnated graphite is a promising nozzle material since it forms an adherent zirconia skin during operation.

## Nuclear energy

Graphite was used in the first self-sustaining atomic pile built by Fermi in Chicago in 1942. It continues to be used extensively as a moderator<sup>18, 19</sup> and reflector chiefly because of the ready availability of high-purity material at relatively low cost. Thus the core of each of the power-producing nuclear reactors at Calder Hall is a graphite structure weighing some 1,150 tons (see illustration at the head of this article). Similarly, thousands of tons of graphite will be required for the C.E.A. nuclear reactors, the first of which are now being built at Berkeley, Bradwell and Hinkley Point.

From the nuclear point of view, the carbon atoms in a moderator should be as densely packed as possible, and the impurity level, particularly of 'poisons' such as boron

and gadolinium, exceedingly low. Neglecting diamonds, the choice is therefore between carbon and graphite. Of the two, graphite is preferred because of its ease of machining, its greater thermal conductivity, thermal shock resistance and higher apparent density.

The stringent purity limits, more exacting than for the manufacture of semi-conductors, have posed new problems. In the United States the conventional process has been used, except that during graphitising the stock has been purified by treatment with gaseous halogens in modified furnaces.<sup>20</sup>

Under irradiation some of the atoms in the lattice are displaced and there is anisotropic bulk growth, known as the Wigner effect. The radiation-induced changes can be considered as analogous to those which would be obtained by reversing the graphitising process. Strength, Young's modulus and hardness all increase, whilst the thermal conductivity is decreased. These changes may be annealed by heating to temperatures in excess of the irradiation temperature, the degree of recovery of properties depending on the annealing temperature.

The design of large graphite structures for power reactors is chiefly complicated by the need to accommodate Wigner growth over periods of many years. The methods used at Calder Hall to solve the design problems have recently been discussed by Long.<sup>21</sup>

Uranium-containing graphites have been extensively investigated as possible fuel elements by the Battelle Memorial Institute.<sup>22</sup> Finally it should be mentioned that boron-impregnated graphite is being used in the thermal shield for the fast reactor at Dounreay.

## Carbon and graphite in the chemical field

In spite of their outstanding inertness to corrosives, the exploitation of carbon and graphite for chemical plant construction has, until recently, been limited because the normal manufacturing process leads to a porous and permeable product. Nevertheless, porous carbon is used for Raschig rings, diffuser elements, filters and digester tank linings, whilst slats for grid-packed towers are made in porous graphite. However, the vast majority of applications involves heat exchange and demands an impermeable material with high thermal conductivity. These requirements are met by impregnation of graphite with liquid organic resins which are subsequently polymerised *in situ*. Phenolic, furan and cashew resins are widely used

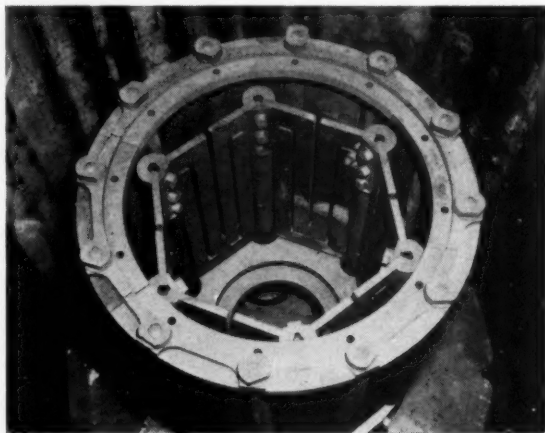
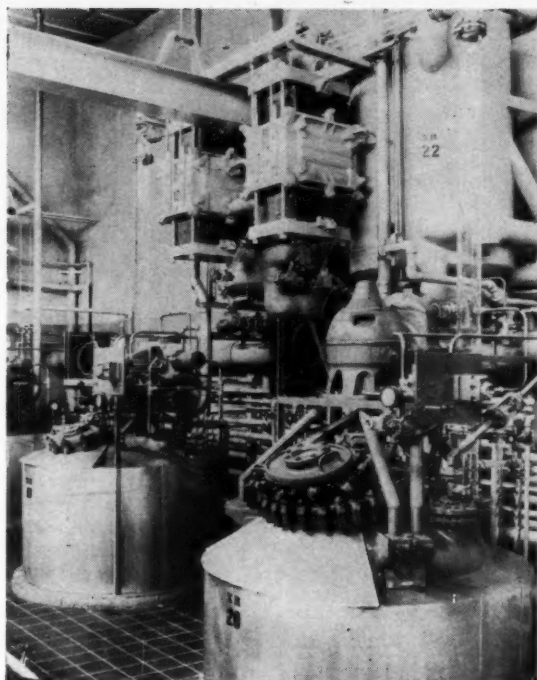


Fig. 3. A 240-kVA graphite resistor furnace during installation of A.E.R.E., Harwell.

[Copyright U.K.A.E.A.]





[Courtesy: Powell Duffryn Carbon Products Ltd.]

Two model 50/50 'Delanium' block heat exchangers in use as condensers for organic solvents.

for this purpose. The corrosion resistance of impermeable graphite is therefore chiefly dictated by the particular resin impregnant employed. Decomposition of the resin generally limits the maximum operating temperature to 170 to 180°C.

The pioneering work in this field was carried out by the National Carbon Co. in the 1930s, whose impermeable equipment such as heat exchangers, pipes, fittings and cascade coolers is marketed under the trade name *Karbate*. A similar range of *Karbate* equipment is now being manufactured in Britain by British Acheson Electrodes Ltd., the principal items being a series of standard tube and shell heat exchangers with one-, three- and five-pass units available.

To take advantage of the fact that the ultimate compressive strength of graphite is about four times its tensile strength, several types of block heat exchanger have been developed. The Powell Duffryn *Delanium* cubic heat exchanger developed in 1950, which was the first of this type, is extremely compact, the 15-in. unit having 50 sq. ft. of heat-transfer surface.<sup>23</sup> The applications of this type of heat exchanger may be seen summarised in Table 2.

### Quick tube remover

Reduction of time needed for removing tubes from condensers, heat exchangers, etc., by up to 80% is claimed for a tube extractor devised by a Newcastle firm, Baxter Bros. (1920) Ltd. According to a description in *Target*, the device consists of

a threaded high-tensile steel mandrel, over the tapered end of which an expanding grooved bit is fitted. This grips the interior of the tube when tightened by a nut.

When the mandrel is in position, a load-spreading mild-steel distance piece, with a friction-lessening ball race collar, is fitted and a second nut

is then screwed down by hand to the portion of mandrel projecting through the ball race collar. A ratchet spanner is then applied and the tube withdrawn 4 in. If the tube cannot then be withdrawn completely by hand, the operation is completed by a free-rolling lever handle, fitted with a mild-steel grip over the outside of the tube.

Table 2. Industrial Applications of Powell Duffryn Cubic Heat Exchangers (after Buis<sup>24</sup>)

By industry	%	By corrosive	%
chemical .. ..	46	sulphuric acid ..	27
electroplating ..	13	hydrochloric acid ..	13
textile .. ..	13	phosphoric acid ..	3
pharmaceutical ..	11	other inorganic liquors	20
food .. ..	3	organic liquors ..	14
miscellaneous ..	14	miscellaneous ..	17

Within the last year, the range of Powell Duffryn units has been extended by the addition of rectangularly shaped blocks with surface areas up to 200 sq. ft. (Fig. 4). Observations of improved heat transfer under turbulent conditions led in 1952 to the development of the Le Carbone-Lorraine *Polybloc* cylindrical block heat exchanger, the principles of which have been described by Hilliard.<sup>25</sup>

### Conclusion

A survey of this nature is necessarily incomplete; in particular no attempt has been made to cover the applications of carbon and graphite powders, which are, of course, used in vast quantities for rubber reinforcement, in printing inks, in lubricating oils and for selective adsorption. The examples quoted are sufficient, however, to show that carbon and graphite articles play a vital part throughout the whole of industry. For this reason, the state of the carbon industry is a good measure of general industrial vigour.

### REFERENCES

(Note.—In the following references the abbreviation S.C.I. is used to denote the Society of Chemical Industry Conference on Industrial Carbon and Graphite held in London, September 1957, the proceedings of which are in the press.)

- <sup>1</sup>CHEMICAL & PROCESS ENGINEERING, 1958, **39** (2), 38.
- <sup>2</sup>M. Vaughan, S.C.I.
- <sup>3</sup>T. G. Pearson, Royal Inst. Chem. Lectures, Monographs and Reports, 1955, (3), 103.
- <sup>4</sup>CHEMICAL & PROCESS ENGINEERING, 1958, **39** (3), 79-81.
- <sup>5</sup>W. C. Gardiner, F.I.A.T. Final Report No. 820, June 1946.
- <sup>6</sup>J. S. Smatko, *Ibid.* 786, April 1946.
- <sup>7</sup>J. Ravenscroft and M. Preston, S.C.I.
- <sup>8</sup>M. S. T. Price (to C. D. Patents Ltd.), Brit. Pat. 714,946.
- <sup>9</sup>*Materials & Methods*, 1957, (5), 177.
- <sup>10</sup>S. A. Murray, *Automobile Engr.*, 1951, (5), 182.
- <sup>11</sup>P. E. Lyddon and R. K. Hurden, S.C.I.
- <sup>12</sup>J. H. Chesters, G. D. Elliot and J. Mackenzie, *J. Iron & Steel Inst.*, 1951, **167**, 273.
- <sup>13</sup>J. R. Lakin and J. Mackenzie, S.C.I.
- <sup>14</sup>L. H. Almond and W. L. Albrecht, *Chem. Eng.*, 1955, **62** (9), 179.
- <sup>15</sup>M. S. T. Price and F. W. Yeats, S.C.I.
- <sup>16</sup>G. E. Ross and D. W. Brown, S.C.I.
- <sup>17</sup>W. D. Smiley, Report WADC-TR-54-491 (Part 2), Nov. 1955, 46 pp.; *Nucl. Sci. Abstr.*, **10**, 9194.
- <sup>18</sup>E. E. Lockett, S.C.I.
- <sup>19</sup>J. F. Fletcher and W. A. Snyder, *Amer. Ceram. Soc. Bull.*, 1957, **36**, 101.
- <sup>20</sup>C. A. Odening and J. C. Bowman, S.C.I.
- <sup>21</sup>E. Long, *Nucl. Pwr.*, 1958, **3**, 58.
- <sup>22</sup>L. D. Loch, J. A. Slyh and W. H. Duckworth, U.S.A.E.C. Report TID-10001, 67 pp., Oct. 13, 1954 (declassified March 16, 1957).
- <sup>23</sup>W. S. Norman and C. H. V. Sawyer, *Ind. Chem.*, 1952, (7).
- <sup>24</sup>M. Buis, *Corr. Prev. & Control*, 1955, (3), 29.
- <sup>25</sup>A. Hilliard, S.C.I.

## I.Chem.E. annual meeting and report

A record increase in membership is noted by the Institution of Chemical Engineers in its annual report. There was a total of 3,823 members (all grades) for 1957 compared with 3,485 for 1956.

More significant than the net increase perhaps, the report notes, is that 335 new students were enrolled. This figure may be compared with the total output from the universities and technical colleges in Great Britain in 1956 of approximately 280.

The report discusses the various means which have been employed to increase recruits to chemical engineering, including the circulation of information to schools. Opportunities for women in chemical engineering have also been investigated and it was decided that an able and determined young woman could succeed in chemical engineering but that vacancies for women chemical engineers in the chemical and allied industries would be limited in the near future.

Other topics dealt with include education and training, and the survey of the output of chemical engineers from the universities and technical colleges (see *CHEMICAL & PROCESS ENGINEERING*, 1958, **39** (5), 149).

At the Institution's 36th annual general meeting the following elections were made: *president*—Sir Hugh Beaver (re-elected); *vice-presidents*—Dr. E. H. T. Hoblyn (re-elected), Mr. W. K. Hutchison, Mr. C. E.

Spearing and Mr. H. P. Weber (re-elected); *joint honorary secretaries*—Mr. F. E. Warner (re-elected) and Mr. R. C. Odams (re-elected); *honorary treasurer*—Mr. F. A. Greene (re-elected); *members of council*—Mr. A. P. Buchanan, Mr. W. J. Chadder, Mr. E. W. Greensmith, Mr. A. H. Isaac and Mr. D. A. B. Llewellyn.

The continuing members of council are: Mr. C. M. Auty, Mr. J. S. Brough, Dr. B. Edgington, Dr. J. F. C. Gartshore, Mr. E. A. K. Patrick, Prof. E. S. Sellers and Mr. R. B. Southall.

At the close of the annual meeting, the president presented the Moulton Medal for 1957 for the paper 'An Investigation of the Transient Response of a Distillation Column, Parts 1 and 2,' by Drs. W. D. Armstrong, H. H. Rosenbrock and W. L. Wilkinson. The Junior Moulton Medal for 1957 was presented for the paper on 'Transmission of Forces Through a Powder Mass During the Process of Pelletizing,' by D. Train. After the meeting, Sir Hugh Beaver gave his presidential address on 'Science and the State.'

At the annual dinner, the toast of 'The Institution of Chemical Engineers' was proposed by the Rt. Hon. Peter Thorneycroft, M.P. This was responded to by the president, Sir Hugh Beaver, K.B.E., who proposed 'Our Guests.' Sir Graham Hayman, chairman of the Distillers Co. Ltd., responded on behalf of the guests.

£ s d

### CHEMICAL PLANT COSTS

Cost indices for the month of April 1958 are as follows:

Plant Construction Index: 171.3

Equipment Cost Index: 162.7

(June 1949 = 100)

£ s d

the company's Buckingham factory which will more than double the chlorate output there. The new chlorate factory at Vancouver was completed during the year.

Among Albright projects in the United Kingdom in 1957 were the extension of Marchon's phosphates plant, the building of a ship for Astoria Shipping & Transport Co., and plants for a number of new phosphorus compounds made by Albright & Wilson (Mfg.). In Australia, one of the main items of expenditure was the building of an additional phosphorus furnace.

Projects for 1958 include additions to research and development facilities in the United Kingdom, further phosphate and sodium chlorate manufacturing extensions in Canada, and a plant for detergent sulphonates in Australia.

The Group's capital expenditure in 1957 came to about £2 million. Sales of all companies expanded, the total being about 10% higher than in 1956.

### Major chemical projects in U.S.A.

Union Carbide Corporation (U.S.A.) recently announced that it will continue with the expansion of its production facilities and will spend something like U.S. \$150 million on new construction.

### Chemical engineering contracts

The annual general meeting of Manchester Oil Refinery (Holdings) Ltd. took place recently. Among topics touched upon in the statement of the chairman, Mr. R. E. F. de Trafford, O.B.E., was the completion of the alcohol recovery plant designed and constructed for Manchester Oil Refinery Ltd. by Petrocarbon Developments Ltd. New orders obtained by Petrocarbon in the chemical engineering field included a second research contract for the Atomic Energy Research Establishment, Harwell, and the design of a polystyrene plant for Poland.

## INDUSTRY REPORTS . . .

### Sulphuric acid and chromium chemical projects

The 1957 expenditure of British Chrome & Chemicals (Holdings) Ltd. included work on the final planning stages for the modernisation and development of the chromium chemical plants at Eaglescliffe and Glasgow. After pointing this out in his annual statement, the chairman of the company went on to mention that it has been decided to lay down a new plant on part of the Glasgow works site. At the same time a new sulphuric acid contact process plant is to be erected at the Eaglescliffe works and the chromium chemical plants there will also be further modernised as part of the major development scheme. Work has now commenced on these projects.

### Phosphorus, phosphates and sodium chlorate

The annual report of Albright & Wilson Ltd. contains a special section on its Canadian subsidiary, Electric Reduction Co. of Canada Ltd., and it is pointed out that the post-war growth in the production of phosphorus and phosphates has been equalled by expansion in sodium chlorate. Two new uses for this material have developed, in the paper industry and in uranium extraction, which require much larger tonnages than are needed for weedkilling.

It is predicted that the demand for chlorate for use in the extraction of uranium from its ore could be greater than the total for all other applications. Work is beginning on extensions to

# SIZE REDUCTION

By R. V. Riley, Ph.D., B.Sc., F.I.M.

*Fundamental studies; primary and secondary crushing; new and improved equipment for crushing and fine grinding in industry; new laboratory equipment*

A NEW book on size reduction is an important event; the more so when its authors are the recognised authorities, Rose and Sullivan.<sup>1</sup> This work of 252 pages is one of the well-known series of monographs from the Powder Science Laboratory of King's College, London University. The object of the new book was to bring together data and, as far as possible, with the present state of knowledge, to present the results in a systematised form. Whether we agree or not that there is yet any fundamental law of grinding, the section on Rittinger's and Kick's laws and Bond's 'third theory' makes interesting reading. To the practical operator, the final section on 'surging,' liner wear and the application of additives to the charge, both in dry and in wet mills, is worthy of study in the way outlined.

Callcott's<sup>2</sup> interesting fundamental article on continuous closed-cycle grinding in a tumbling mill, mentioned in last year's review,<sup>3</sup> was completed in a more recent publication in Australia.

The principal property of a solid surface is its surface energy. In any consideration of the breakdown of solids, one is concerned with the production of new surfaces and hence it is to be expected that surface energy will play a foremost part. This was recognised by Kuznetsov, a Russian scientist whose work has been fully translated into English and is published as a 283-page monograph.<sup>4</sup> Kuznetsov claimed that all solids could be roughly divided into two groups: brittle and ductile. The energy expended in breaking up brittle materials was accounted for by elastic deformation, heat generation and to a great degree in overcoming surface energy. In the working of ductile solids, elastic and plastic deformation absorbed most of the available energy and the amount required to overcome surface energy was relatively small. Experimental work on the fracture of rock salt crystals showed that the energy require-

ments were related to the surface scratch hardness of the material.

This translation is one of the most valuable additions to our recent literature upon the fundamentals of size reduction. Many of its 121 references are to the literature of the Soviet

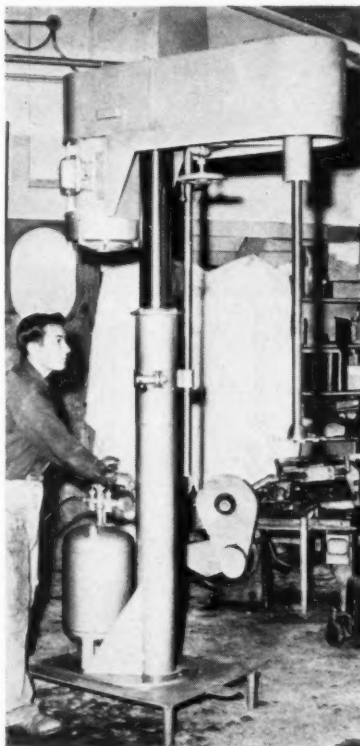
Union, which often escapes all but the keenest research workers in the Western world.

Nijman,<sup>5</sup> in a review on the theory of ball-mill grinding, concluded that, even if one neglected abrasion and considered only brittle fracture, it was not possible to predict with any degree of accuracy the size range of the crushings from one breakage operation. This is a sad reflection upon the state of our theoretical knowledge despite the various well-known theories of Kick, Rosin-Rammler and, more recently, Bond, and must act as a spur to further effort by our research workers.

Labat<sup>6</sup> made a practical plea for the more extensive appreciation of the advantages of progressive and controlled crushing in a reduction cycle comprising a crusher, a screen and a mixer. The mixer was used to incorporate the incoming material with the returns from the screen. Progressive and controlled grinding avoided the four faults found with rapid, one-pass 'classic' crushing, namely low output, crusher wear, variations in size of product and too large a dust production.

## Gyratory crushers

An improvement in the construction of rock crushers is MacLeod's<sup>7, 8</sup> patented concave lining tiles, which fit together to give the conical lined casing of a gyratory crusher and are yet easily detachable when replacement of a worn or damaged lining becomes necessary. Pneumatic cylinders placed circumferentially around the main frame of a gyratory crusher serve to give automatic release for oversize lumps of ore<sup>9</sup> and in another design the release is obtained by swinging the crusher shaft.<sup>10</sup> Other British patents have described improved designs for helping in the easy maintenance of the crusher shaft<sup>11-14</sup> and better lubrication.<sup>15</sup> In one new design the usual bevel gears are eliminated in favour of a direct drive from a belt pulley to the crushing cone sleeve.<sup>16</sup>



[Courtesy: Guest Industrials Ltd.]

The Cowles model 510 VHV distributed by Morehouse International is used for dispersing and de-agglomeration purposes. The stainless-steel impeller whirling at a rim speed of 6,000 ft./min. sets up 'hydraulic shear' and a very high degree of turbulence in the liquid. Viscosities as high as 50,000 cp. may be handled in batches up to 500 gal. The disperser is available fitted with electric two- or three-phase motors, 20 to 40 h.p.



The outlet from a crusher has been arranged so as to discharge on to spaced parts of a single transverse conveyor.<sup>17</sup> Size adjustment may be obtained by mounting hydraulic cylinders on the outer crushing member of a gyratory crusher.<sup>18</sup>

### Jaw crushers

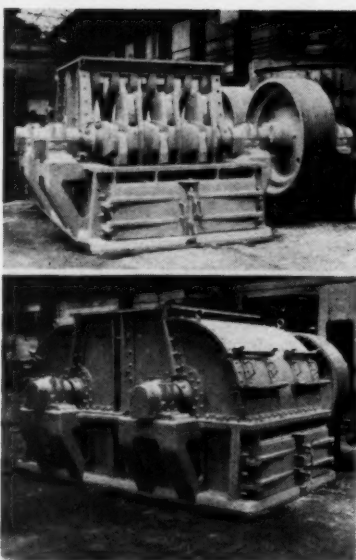
As with other forms of primary crushers, jaw crushers are required to break minerals into smaller pieces of as regular a size as possible, with the minimum splinter and dust formation. It is claimed that this may be accomplished by providing different oval paths for points on the eccentrically mounted jaw face,<sup>19</sup> or by arranging for the narrowest crushing gap to lie in a plane containing the axes of rotation of the two eccentric shafts which move the jaws at a high striking speed in opposite directions.<sup>20</sup> A double-acting jaw crusher with two movable jaws and a central-tensioned wearing plate has been described.<sup>21</sup> Klockner-Humboldt-Dentz A.G. claimed several improvements in their toggle-joint drive and adjustable bearing plate,<sup>22</sup> rubber mountings for the oscillating jaw or its pivot shaft,<sup>23</sup> multipart pressure plates,<sup>24</sup> the spring return arrangement<sup>25</sup> and adjustable abutment.<sup>26</sup>

There are also new safety devices to prevent damage to the jaw crusher by overloading<sup>27</sup> and selected crushing surfaces to give specified results.<sup>28</sup>

Two laboratory jaw crushers are worthy of comment. One by Knapp and Bates Ltd.<sup>29</sup> is lightly constructed from an aluminium alloy but produces the maximum strength and performance. The eccentric movement operating from the top of the moving jaw is sealed in an oil bath and the jaw faces are of stellite. The other<sup>30</sup> is novel in that it can be operated by hand and is thus suitable for field work. It is a lightweight unit, easily portable, and reduces material from 1½-in. cube to ⅛-in. at the rate of 40 to 45 lb./hr.

### Impact crushers and hammer mills

E. Puffe,<sup>31</sup> in a comprehensive review, dealt with the application of impact crushers to the disintegration of coal and iron ores. E. Andreas<sup>32</sup> specifically described the use of a German-built impact crusher for siderite and limonite. The crusher bars of an impact crusher<sup>33</sup> have been so designed and spaced to allow of progressively finer crushing over the periphery of the hammer rotor so as to give a constant torque resistance. This mill gives a free crushing effect on the



[Courtesy: Edgar Allen Ltd.]

Two views of the 'Stag' double-shift hammer mill with the internal view (above) showing hammers, hammer carriers and grate bars, and the photo below giving an external view of the mill in its casing. This machine can be used as a primary breaker for crushing hard materials such as limestone from a maximum feed size of about 30 in. cube and delivers a product about 1 in. cube. It has 'Cromax' steel grate bars and manganese-steel hammers. The B.16 machine without screens is capable of dealing with 200 to 225 tons/hr. of limestone and with screens 120 to 140 tons/hr. The power required is about 1½ to 2 h.p./ton without screens and 2½ to 3 h.p./ton with lower screens.

product, thereby reducing the spread of sizes. In an air-swept hammer mill, the crushings are swept into a surrounding casing which increases in cross-section towards the exit so as to give a constant scavenging effect.<sup>34</sup>

Instead of a perforated plate for classifying purposes<sup>35</sup> the desired control of fineness was achieved by one Japanese inventor<sup>36</sup> by including, in the outer casing, plates which serve to deflect the throw of particles from the hammers to give a greater or less rebound and impact with the rotor arms. Other methods of size control have included a sliding crusher casing,<sup>37</sup> an anvil bar mounted on a rocker assembly which can be adjusted together with the rotor<sup>38</sup> and a wedge adjustment between a grinding plate and the rotor.<sup>39</sup>

Air flow through hammer mills is now regarded as a convenient method of introducing the material to be crushed,<sup>40</sup> of removing the crushings<sup>41</sup> and for classifying the material within the mill.<sup>42</sup>

The controlled crushing of coal for coking purposes is now frequently demanded in order to utilise some of the poorer coking coals which have been found to produce good cokes when carefully blended. For this purpose, hammer mills have been used.<sup>43</sup> The fineness of grinding required is 90 to 93% content of 0.3 mm. particles<sup>44</sup> and, since no further improvement is obtained and harm is done by finer grinding, some care must be taken to avoid these fines. Thus the indiscriminate action of the hammer mill was frowned upon by devotees of the Burstein process of coal preparation for coking.<sup>45</sup>

Hammer mills with resilient devices to prevent damage to the rotary hammers have been described.<sup>46, 47</sup> Novelities from the patent literature include a device for breaking up large blocks whilst still resting on a conveyor by upwardly operating rotary hammers<sup>48</sup> and a shredder for bundled steel scrap.<sup>49</sup> Conveniently, a crushing unit for coal and iron ore may be associated with an underground conveyor system<sup>50</sup> and a coal-grinding device linked with a steam generator with provision for a controlled grit return.<sup>51</sup> Sturtevant Engineering Co.<sup>52</sup> have a new range of laboratory sample preparation crushers including a small hammer mill designed to handle moderately hard materials such as barytes, bauxite and gypsum. A new design of slugger roll crusher was patented.<sup>53</sup>

### Roll mills

Many types of roll mill have been described, from the fine pigment mill, comprising a train of three or more finely ground rollers in bearings in adjustable pedestals<sup>54</sup> to the primary crushing roll mills for the comminution of coke breeze<sup>55</sup> or coal.<sup>56</sup>

Some attention has been given to the fixing of the crushing roll shell on to the roll core. One method is to bolt the two halves and then to weld over the longitudinal seam.<sup>57</sup> Some hard metal shells, however, cannot be so welded and in these cases the bolt pattern described in a recent patent<sup>58</sup> appears very suitable. Each segment is secured by taper shank bolts secured to the rim of the section roll core.

Adjustment of the roll trains to allow for the inevitable wear on the rolls may be accomplished by the movement of an eccentric on the roller supporting trunnion shaft<sup>59</sup> or by screwed bars working in nuts which actuate the roll movements.<sup>60</sup> Hydraulic cylinders continue to be applied more and more for roll adjustment<sup>61-64</sup> and for the continuous adjustment of

the scraper blade in mills for grinding pastes.<sup>65</sup> Manually adjustable grating bars<sup>66</sup> and feed control<sup>67</sup> systems have also been described in patents.

Roller mills having vertically mounted rolls working in an annular track have been improved by using resiliently located distance pieces<sup>68</sup> and spring loading of the roll towards the grinding ring.<sup>69</sup>

### Ball mills

The ball mill is probably the most versatile of fine grinders; it is used under a variety of conditions on hard and soft grist and with many types of grinding media. One interesting use of the ball mill is for the wet grinding of sulphide ores.<sup>70</sup> The mill was turned at a speed well below 'cataracting' speed so that the grinding action was by rubbing rather than by impact. As the ball mass climbed the leading side of the mill, it vacated a segmental pool which consisted entirely of the slime. The axial exit from the mill skimmed off the finest particles present in the upper layers of this 'pool.' (See diagram below).

A recent development in ball-mill liners consists of the wearing plates being cast with a continuous spiral series of ribs set at an angle of not more than 30° to the axis of the mill.<sup>71</sup> In another design<sup>72</sup> the lining plates are provided with both ribs and depressions constituting helices of a hand opposite to the direction of rotation of the shell viewed from the inlet end.

The vibrating ball mill appears to be gaining favour. Two such air-swept mills have a baffle plate separating the inlet charge from the crushings leaving the mill and are vibrated by out-of-balance weights mounted axially.<sup>73, 74</sup> The unbalancing weight may be concentrated at the inlet end only so as to obtain a greater vibratory

effect at that end.<sup>75</sup> A similar effect may be obtained by providing an epicyclic motion<sup>76</sup> and one oscillatory mill mounted vertically has been described.<sup>77</sup>

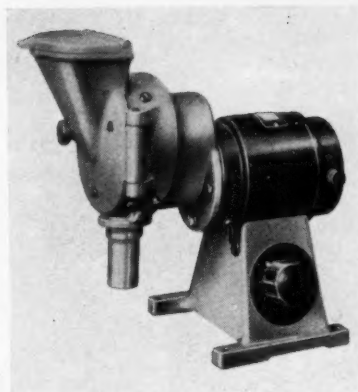
### Tube mills

For cement grinding, the tube mill reigns supreme. Two combination tube mills 45 ft. long × 8 ft. 6 in. diameter for wet grinding raw materials to a fineness of 8% residue on a 170 B.S. sieve are suitable for a rate of production of 600 tons/24 hr. of



[Courtesy: Glen Creston Ltd.]

The laboratory sample mill is a specialised form of disc mill constructed to meet the requirements of a testing laboratory. It will handle grain, chemicals, drugs, coal and other not-too-hard substances. Practically no material is lost during grinding and the sample is recovered in a 100-cc. dust-proof, transparent plastic hopper. Cleaning the mill is easy since all parts of the grinding chamber are accessible on removing two bolts. The grinder consumes only 80 w. at 220/240 v. From an initial size of  $\frac{3}{16}$  in. the product will usually pass 60 to 85 mesh sieves.



[Courtesy: Glen Creston Ltd.]

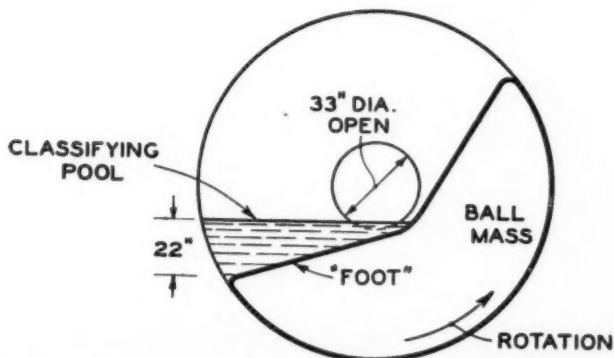
The 'Micro' hammer mill has been designed to reduce the particle size of small samples of fibrous materials, foodstuffs, paper, coal, etc., to a degree required for analytical work. Within 30 to 120 seconds the materials for analysis are pounded into powder by the three stainless-steel hammers and the sample is then passed into a transparent plastic tube of 35 cc. capacity.

cement clinker.<sup>78</sup> The mill ends were of cast steel well ribbed and fitted with trunnions. The cylinder was of mild-steel plate lined with chromium-steel liner plates attached by wrought-iron bolts. The grinding media consisted of high-carbon forged steel balls ranging in diameter from 2 to 4 in. in the preliminary compartments, and in the finishing compartments the balls were  $\frac{3}{4}$  to 1  $\frac{1}{4}$  in. diameter of cast steel. One cement tube mill had frusto-conical lining sections tapering in the direction of movement of the cement being ground.<sup>79</sup>

In an air-swept tube mill, supplementary air was admitted through specially designed slots in the drum wall.<sup>80</sup>

### Disc mills

Disc mills have been described which have three distinct grinding zones<sup>81</sup> and these are particularly suitable for the preparation of groats, fruit, green food, hay, cereals, bulbs, sugar, etc. Another disc mill was fitted with a hydraulic pressure adjuster to move the spacing of the discs.<sup>82</sup> Such a mill is proposed for the grinding of paint, ink or chocolate. For very fine powders, a disc grinder having a stationary and rotating disc was described.<sup>83</sup> A wood chip grinding machine has a smoothly tapering conical-shaped rotor merging into a flat disc terminal fine grinding zone.<sup>84</sup> A similar mill for pastes, pigments, mayonnaise, oil mixtures, etc., employed special scraping surfaces.<sup>85</sup> Two German mills for flour grinding have also been described.<sup>86, 87</sup>



Ball mill development covered in U.S. Patent 2,791,382 (J. F. Myers).

## Beater mills

Beater mills continue to find application for the shredding of fibrous materials including foodstuffs.<sup>88-90</sup> Improvements to the beater bars<sup>91</sup> and to the beater pins<sup>92</sup> and casing<sup>93</sup> have been described.

Meat choppers and grinders are usually specially designed beater mills<sup>94</sup> and one described recently was provided with a cooling arrangement.<sup>95</sup>

Modern canteens and kitchens fit waste grinders, and a large amount of ingenuity is being exercised in the design of these now-important items of hardware.<sup>96</sup> One had a sloping upturned rim which, when spinning in the off-take from the sink, urged the waste material against grinding cutters from which it discharged over the rim in a comminuted form into the drains.<sup>97</sup> As provision against splashing when the waste grinder is in operation, one pattern employed a resilient splashguard.<sup>98</sup> Another advanced form of domestic waste grinder was fitted with a timed flushing arrangement which washed away the debris into the drains on the completion of the grinding operation.<sup>99</sup>

## Miscellaneous mills and novelties

Two types of colloid mill have been described, one based upon a form of pin mill<sup>100</sup> and one food processing mill of conical type.<sup>101</sup> Frozen meat, fish and the like in large chunks may be reduced in a heavy-duty grinder comprising a worm screw feed thrusting the charge against a shredding orifice grinder plate.<sup>102</sup> Crushed ice, a very important commodity on the other side of the Atlantic, may be produced in two sizes from a single machine by changing the direction of rotation of the beater.<sup>103</sup>

Promising results were obtained in freeze-grinding experiments on tough or resilient synthetic materials such as nylon, polythene and rubber. Not only did the induced brittleness help in the rapid reduction of the polymer but molecular degradation was avoided because of the absence of heating effects. Furthermore, fire and explosion hazards were minimised. In recent field trials<sup>104</sup> stainless-steel high-speed hammer mills cooled in liquid nitrogen were used successfully. One such process by a German company has been granted a British patent.<sup>105</sup> Another method of continuous milling of plastics has been described.<sup>106</sup>

A method of breaking up porous ceramics or concrete consists of incorporating in it a material which when wetted results in an expansion, thereby causing disintegration.<sup>107</sup>

Metal powder production may be carried out by means of electric sparks in a dielectric fluid, presumably a development of the well-known electro-machining techniques.<sup>108</sup>

There have also been improvements in jet mills.<sup>109</sup> The jet mill appears to be finding an application for pulverising coal used on a locomotive.<sup>110</sup>

A new plough-contoured scraper is claimed for a dry pan mill<sup>111</sup> and further improvements in the electronic control of mills were claimed by Weston.<sup>112, 113</sup>

Finally, there was a reference<sup>114</sup> to the interesting range of laboratory size-reduction machines exhibited at the Salon de la Chemie in Paris last year.

## REFERENCES

- <sup>1</sup>H. E. Rose and R. M. E. Sullivan, 'A Treatise of the Internal Mechanics of Ball, Tube and Rod Mills,' Constable, London.
- <sup>2</sup>T. G. Callcott, *Proc. Australasian Inst. Mining & Met.*, March 1957, (181).
- <sup>3</sup>R. V. Riley, *CHEMICAL & PROCESS ENGINEERING*, 1957, **38** (6), 229-240.
- <sup>4</sup>V. D. Kuznetsov, 'Surface Energy of Solids' (translation from the Russian, D.S.I.R.). H.M.S.O.
- <sup>5</sup>J. Nigman, *Brit. Chem. Engg.*, 1958, (2), 76.
- <sup>6</sup>M. Labat, *Ceramics*, April 1957, **98**, 20-21.
- <sup>7</sup>U.S. Pat. 2,813,685.
- <sup>8</sup>Brit. Pat. 771,166.
- <sup>9</sup>U.S. Pat. 2,787,425.
- <sup>10</sup>U.S. Pat. 2,820,596.
- <sup>11</sup>Brit. Pat. 773,182.
- <sup>12</sup>Brit. Pat. 771,430.
- <sup>13</sup>Brit. Pat. 773,853.
- <sup>14</sup>Brit. Pat. 770,261.
- <sup>15</sup>U.S. Pat. 2,787,424.
- <sup>16</sup>Brit. Pat. 786,258.
- <sup>17</sup>Brit. Pat. 771,159.
- <sup>18</sup>Brit. Pat. 786,714.
- <sup>19</sup>Brit. Pat. 771,428.
- <sup>20</sup>Brit. Pat. 776,621.
- <sup>21</sup>U.S. Pat. 2,816,717.
- <sup>22</sup>Brit. Pat. 774,862.
- <sup>23</sup>Brit. Pat. 770,978.
- <sup>24</sup>Ger. Pat. 1,023,954.
- <sup>25</sup>Ger. Pat. 1,011,259.
- <sup>26</sup>Ger. Pat. 1,012,146.
- <sup>27</sup>Ger. Pat. 1,012,147.
- <sup>28</sup>Brit. Pat. 770,748.
- <sup>29</sup>*CHEMICAL & PROCESS ENGINEERING*, 1957, **38** (11), 454.
- <sup>30</sup>*Ibid.*, (7), 300.
- <sup>31</sup>E. Puffe, *Zeit. Erz. Metal*, 1955, **8** (12) 570-580.
- <sup>32</sup>E. Andreas, *Canadian Mining J.*, 1957, **78** (1), 56-59.
- <sup>33</sup>U.S. Pat. 2,822,138.
- <sup>34</sup>U.S. Pat. 2,808,997.
- <sup>35</sup>Brit. Pat. 772,381.
- <sup>36</sup>U.S. Pat. 2,792,995.
- <sup>37</sup>U.S. Pat. 2,785,865.
- <sup>38</sup>Brit. Pat. 790,092.
- <sup>39</sup>Ger. Pat. 1,022,446.
- <sup>40</sup>Brit. Pat. 775,262.
- <sup>41</sup>U.S. Pat. 2,800,286.
- <sup>42</sup>Brit. Pat. 766,500.
- <sup>43</sup>I. A. Tumarkin, *Coke & Chem.*, 1957, **8**, 7-9.
- <sup>44</sup>V. G. Zashvara, *Steel*, 1954, **6**, 495-501.
- <sup>45</sup>*J. Iron & Steel Inst.*, 1958, (2), 171.
- <sup>46</sup>U.S. Pat. 2,820,597.
- <sup>47</sup>U.S. Pat. 2,813,684.
- <sup>48</sup>Brit. Pat. 771,433.
- <sup>49</sup>Brit. Pat. 790,740.
- <sup>50</sup>Ger. Pat. 1,013,248.
- <sup>51</sup>Ger. Pat. 1,018,707.
- <sup>52</sup>*Ceramics*, May 1957, **9** (99), 24.
- <sup>53</sup>U.S. Pat. 2,781,980.
- <sup>54</sup>Brit. Pat. 764,356.
- <sup>55</sup>Brit. Pat. 780,780.
- <sup>56</sup>Brit. Pat. 773,362.
- <sup>57</sup>U.S. Pat. 2,798,676.
- <sup>58</sup>U.S. Pat. 2,803,411.
- <sup>59</sup>Brit. Pat. 774,404.
- <sup>60</sup>U.S. Pat. 2,805,028.
- <sup>61</sup>U.S. Pat. 2,794,603.
- <sup>62</sup>Brit. Pat. 763,941.
- <sup>63</sup>Brit. Pat. 763,942.
- <sup>64</sup>U.S. Pat. 2,797,635.
- <sup>65</sup>Brit. Pat. 785,105.
- <sup>66</sup>Ger. Pat. 1,018,705.
- <sup>67</sup>Ger. Pat. 1,015,301.
- <sup>68</sup>Brit. Pat. 771,185.
- <sup>69</sup>U.S. Pat. 2,815,903.
- <sup>70</sup>U.S. Pat. 2,791,382.
- <sup>71</sup>U.S. Pat. 2,809,789.
- <sup>72</sup>U.S. Pat. 2,801,804.
- <sup>73</sup>U.S. Pat. 2,789,773.
- <sup>74</sup>U.S. Pat. 2,818,220.
- <sup>75</sup>U.S. Pat. 2,819,849.
- <sup>76</sup>Ger. Pat. 1,013,946.
- <sup>77</sup>Ger. Pat. 1,019,891.
- <sup>78</sup>*Edgar Allen News*, 1957, **36** (420), 121-123.
- <sup>79</sup>Brit. Pat. 778,324.
- <sup>80</sup>Ger. Pat. 1,012,148.
- <sup>81</sup>Brit. Pat. 785,103.
- <sup>82</sup>Brit. Pat. 789,359.
- <sup>83</sup>Ger. Pat. 1,014,828.
- <sup>84</sup>U.S. Pat. 2,823,871.
- <sup>85</sup>Brit. Pat. 786,911.
- <sup>86</sup>Ger. Pat. 1,023,953.
- <sup>87</sup>Ger. Pat. 1,023,952.
- <sup>88</sup>Ger. Pat. 1,011,702.
- <sup>89</sup>Ger. Pat. 1,016,103.
- <sup>90</sup>Ger. Pat. 1,016,114.
- <sup>91</sup>Ger. Pat. 1,015,304.
- <sup>92</sup>Ger. Pat. 1,023,955.
- <sup>93</sup>Brit. Pat. 768,976.
- <sup>94</sup>U.S. Pat. 2,801,665.
- <sup>95</sup>U.S. Pat. 2,792,042.
- <sup>96</sup>U.S. Pat. 2,822,988.
- <sup>97</sup>Brit. Pat. 765,155.
- <sup>98</sup>U.S. Pat. 2,785,864.
- <sup>99</sup>U.S. Pat. 2,785,863.
- <sup>100</sup>Brit. Pat. 789,881.
- <sup>101</sup>Brit. Pat. 790,340.
- <sup>102</sup>U.S. Pat. 2,796,901.
- <sup>103</sup>U.S. Pat. 2,803,410.
- <sup>104</sup>*New Scientist*, May 9, 1957, p. 20.
- <sup>105</sup>Brit. Pat. 788,542.
- <sup>106</sup>U.S. Pat. 2,803,039.
- <sup>107</sup>Brit. Pat. 789,700.
- <sup>108</sup>Ger. Pat. 1,016,537.
- <sup>109</sup>U.S. Pat. 2,787,422.
- <sup>110</sup>Brit. Pat. 785,579.
- <sup>111</sup>U.S. Pat. 2,818,219.
- <sup>112</sup>Brit. Pat. 782,523.
- <sup>113</sup>Brit. Pat. 783,113.
- <sup>114</sup>*CHEMICAL & PROCESS ENGINEERING*, 1957, **38** (1), 24.

**Gas-liquid chromatography.** A brochure describing the Mark 2 version of their gas-liquid chromatographic apparatus has been produced by Griffin & George Ltd. It is stated that the separation of components in mixtures up to boiling points of about 350°C. at A.P. is rapidly and cleanly accomplished, the recorder tracing a permanent record of the analysis which can be repeated at will using the same conditions of operation.



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## Coating resists heat and acid

A heat-resisting bituminous paint now available is designed to give protection against sulphurous fumes and acid condensates in temperatures up to 400°F. It is claimed to have excellent resistance to *wet* chemical corrosion in these conditions.

This material has for many years been used for the protection of internal surfaces of asbestos cement flue pipes. It can also be used on the internal surfaces of concrete chimneys and stacks. Makers: Tretol Ltd.

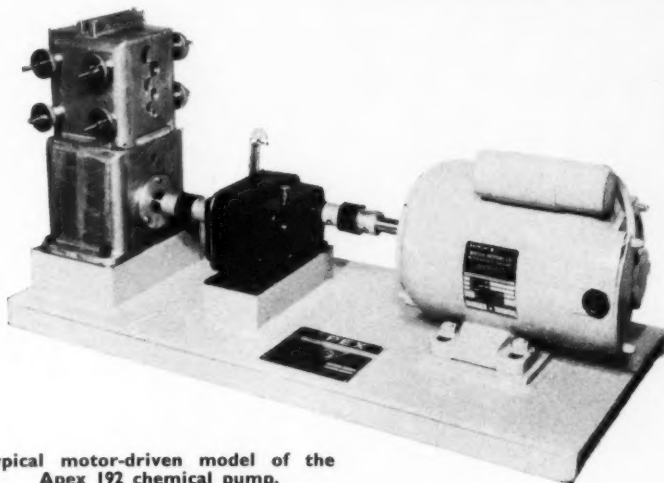
CPE 917

## FLEXIBLE HOSE FOR CORROSIVES

A new polythene-lined rubber hose for the conveyance of concentrated mineral acids has been developed by Dunlop under the trade name of *Valithene*. Applications for which it is considered suitable include: temporary pipelines; lead pipe replacement in chemical plant; chlorine water plant pipes; pipelines for dye-stuffs; pharmaceutical and fine organic chemical plant; and the conveyance of liquid foodstuffs, wines and spirits and of soap detergents.

The hose is available in a range from  $\frac{1}{2}$  to 3-in. bore, and lengths of up to 60 ft. can be supplied. Working temperatures should in general not exceed 60°C., although very low-pressure steam may be used for cleansing, provided that the other end of the hose is open to the atmosphere. Maximum working pressure is 50 p.s.i.

CPE 918



Typical motor-driven model of the Apex 192 chemical pump.

## New chemical pump

The Apex 192 *Sinus* chemical pump is a general pumping unit for use in the research and process departments. It is claimed that it will pump liquids or gases without being affected by solids in solution and without the risk of contaminating the fluids conveyed. Contamination is avoided without using stainless steel or other expensive acid-resisting materials. The pump is self-contained and easy to install.

The pump operates by compressing a rubber tube carrying the liquids between a pressure plate and a number of fingers which operate in a 'sinus' movement. The pressure against the rubber tube imparts a positive unidirectional movement of the liquid. The design and finish of the fingers is such that the correct tubing used will stand long usage without any appreciable wear due to the constant squeezing. The pump will operate with a variable output easy of control.

The varying rates of flow are achieved by:

- (1) Varying the size of the tubing used.
- (2) Altering the speed of the operating fingers.
- (3) Adjusting the load placed on the pressure plate.

The rates of flow obtained with the above variables in the case of the smallest model No. 192A is 25 gal./hr. at no head at 400 r.p.m. with  $\frac{1}{2}$ -in. bore tube and 2 gal./hr. at 50 ft. head at 100 r.p.m. with a  $\frac{3}{8}$ -in. bore tube.

The fitting of the liquid carrying tube to the pump is simplified by the top half carrying the tube being split, enabling any connections on the ends of the tube to be fitted before the tube is placed in the pump.

These pumps can be supplied motor driven complete on a baseplate with an infinitely variable speed reducer with an overall ratio of 4 : 1.

CPE 919

## C.P.E.'S MONTHLY REPORT AND READER SERVICE



## Gas scrubbers

The Chemico Pease-Anthony gas scrubbing equipment is available in two types—the cyclonic scrubber and the venturi scrubber—for the removal of micron and sub-micron dusts, fumes, mists and fogs from gas streams. It is claimed that the apparatus is equally effective for the reduction of air pollution and for cleaning industrial gases; and that it also enables valuable metals and chemicals to be recovered.

In the cyclonic scrubber, dirty gas enters tangentially at the bottom of the apparatus and pursues a spiral path upwards. Spray is introduced into rotating gas from an axially located manifold in the lower part of the unit. The fine spray droplets are caught in the gas stream and by centrifugal force are swept across to the wall of the cylinder, colliding with and collecting the dust particles on route. The water and collected dust runs down the walls and out at the bottom of the unit.

In the venturi scrubber dirty gas, at high velocity, impinges upon and atomises a curtain of liquid introduced through jets at the throat of the venturi. Differential velocities of gas and atomised liquid result in collision of mist or dust particles with liquid droplets. The coalescence of mist or

agglomeration of dust resulting from this collision make simple cyclonic separation possible.

This equipment is being offered in the United Kingdom by Chemical Construction (Great Britain) Ltd.

**CPE 920**

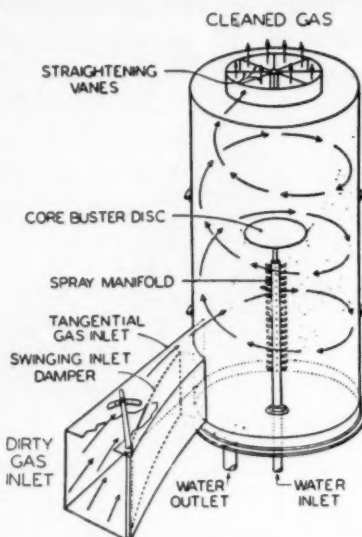


Diagram illustrating principles of Chemico Pease-Anthony cyclonic-spray scrubber.

fluted cylinder wall. The speed of the material is again increased as it flows in a spiral between each blade of the rotor stages. The passage of individual blades passing in close proximity to the fluted walls and the difference of air pressure above and below each diaphragm, and on either side of each rotor blade, causes these parts to vibrate with a sound energy in excess of 120 decibels over a wide range of frequencies. Under these conditions intersecting subsonic shock waves caused by reflection provoke intense turbulence and vortices.

Thus the same air which is utilised for carrying the material supplies the energy for producing the required mechanical effect to break the material down.

**CPE 921**

## Versatile automatic welding equipment

The Autopak welding equipment incorporates a new conception in automatic arc voltage control. Portable and easily operated, it can be used as a manual welder and at the same time it can be extended to any fully automatic application.

The automatic control equipment consists of components associated with the transformer which are used to feed and control the automatic welding head. There are two items of control: the control unit itself and the welding circuit contactor panel.

Accessories available include a small universal positioner to carry the welding head, flux hopper, welding current ammeter, and manual welding accessories. The suppliers are Rockwell Ltd.

**CPE 922**

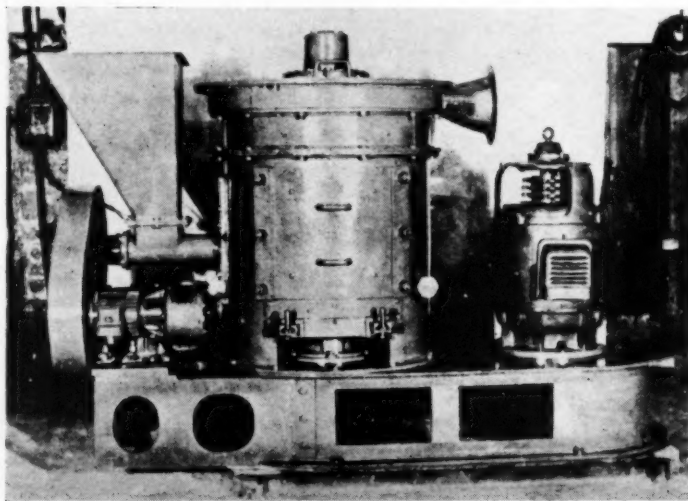
## Fluid energy mill

The Russell fluid energy mill employs a unique method of reducing matter to ultra-fine particle size. The material is accelerated and spun by high-speed air waves and these waves cause the individual particles to collide violently with each other and so split up.

The mill consists of a static cylinder fitted with a fluted interior wall, with a multi-stage axial rotor assembly inside, remotely driven by an electric motor. Air is taken into the mill through adjustable inlets by the lowest stage of the rotor, an impeller. Material is fed to the second vaned stage. Situated above this are the remaining rotor stages, a classifier and an expeller fan, each rotor separated by a diaphragm. Oversize material can be recirculated by an external duct from the classifier stage to the second stage of the rotor. The number of rotor stages can be varied to suit a particular application. Flow adjustments can be made to the air intake, the material intake, the outlet and the recycling ducts.

Material taken in by the mill is

accelerated to the periphery speed of the rotor, which is normally about 300 ft./sec. At this stage some attrition of the largest particles takes place between the vaned rotors and the



Russell fluid energy mill.



Michigan tractor shovel 175A loading coal wagon with 5 cu. yd.-capacity bucket.

### Bulk-handling machinery

With large-capacity buckets for their 175A and 75A tractors, Michigan (Great Britain) Ltd. are now providing machines for bulk handling of materials such as coal, coke and chemicals. The model 175A powered with a Leyland diesel engine developing 147 b.h.p. has a lifting capacity of 15,000 lb. and is now available with bucket capacity up to 5 cu. yd. nominal, carrying a heaped load of 6 or 7

cu. yd. The 75A model is powered by a Leyland or Perkins engine of 75 to 100 b.h.p. and has an 8,000-lb. lifting capacity with bucket capacity from 1½ up to 2½ cu. yd.

Michigan tractors incorporate front-wheel drive, planetary wheel drive axles, power shift transmission and power steering providing fingertip control and ease of operation comparable with a private car.

CPE 923

### Control valve

The *Sala* rubber valve is designed especially as a control valve giving a round hole down to a very small part of the full area and giving a venturi flow pattern which results in low friction loss. Low friction of a streamlined flow through a round hole, and the cushioned action of a very thick rubber wall, accounts for the exceptional abrasion resistance, the makers say.

When used for abrasive slurries it has an advantage in that the flowing material does not build and plug the valve.

The adjustment of the diameter of the valve is controlled through a

hydraulic pressure operator, which either can be mounted on the valve or any other place as remote control. The diameter of the valve is proportional to the hydraulic pressure on the outside of the rubber bushing, and it is easy to know the diameter of the valve from the pressure gauge, where one or several valves are arranged for remote control from one central point. Internal line pressure has negligible effect upon closure pressure of the operator.

The connection flanges of the valve are available rubber-lined for especially abrasive and corrosive slurries.

CPE 924

### New industrial inspection kit

The *Ellispection* kit comprises a series of rigid and flexible probes with fixed and movable mirrors, magnifiers and midget battery-operated electric lights, the smallest being ¼ in. in diam.

All parts are interchangeable and interlocking, thus one or more parts in

any combination make it possible to probe, illuminate and inspect machinery, pipe assemblies, chemical plants, electronic valves, etc.

The kit is housed in a fitted, black hardwood case which is both compact and easy to carry.

CPE 925

### V-notch liquid flow recorder

The *Arkon* recorder automatically provides a clear, continuous record day and night of outflow of works and gasworks effluent of all kinds and liquors used in manufacturing processes. Use is made of the V-notch weir principle in which the head of liquid over the weir has a known

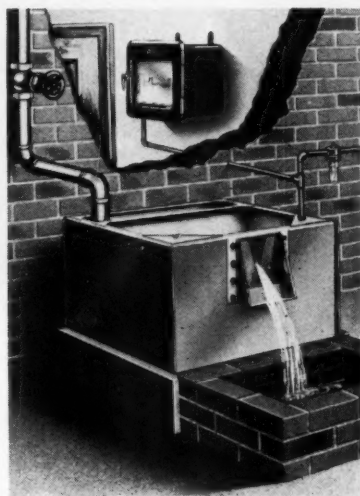


Photo shows application of flow recorder.

relationship to the rate of flow, the angle of the V-notch being chosen to suit the maximum rate of flow in the installation.

A small supply of air or gas is taken to a dip tube which is inserted in the liquid at a suitable point. From the dip tube a connection is taken to an *Arkon* 1600 model recorder. The pressure is equivalent to the head of liquid on the dip tube.

As the head varies, so the pressure to the recorder varies which writes this information on a chart in terms of gallons (or other selected units) per minute, hour or day, as desired.

The recorder can be installed at any reasonable distance from the flowing liquid, and thus remains unaffected by corrosive fumes.

Suppliers: Walker, Crosweiler & Co.

CPE 926

### Vibratory feeders

It has been announced by the Blending Machine Co. Ltd. that they are supplying a new range of vibratory feeders of the base-mounted type, which can be used for the purpose of conveying or feeding a wide variety of powdered or granular materials at a controlled rate between one stage of a process and the next.

The feed rate, or speed of travel of the material, can be varied instantaneously and infinitely between minimum and maximum feed by means of a simple controller supplied with each feeder. The units are made to operate on a single-phase a.c. electric supply. Five sizes are available, ranging in capacities from 150 lb./hr. to 15 tons/hr.

The units can be supplied with tray shapes, such as tubular, oval, 'V' section, etc., and can also be supplied fitted with feed hoppers to suit specified requirements.

The feeders can be used in conjunction with mixing machines, grinders, mills, etc., and in most cases, the output of the feeder can be matched to suit the input requirements of the particular mixer or mill by having a special master controller fitted in circuit, which is controlled by the driving motor of the mill. Other control systems are available for purposes of automation as required.

**CPE 927**

### **New kit for water treatment control**

A new and simple testing kit has been produced that enables control tests to be made easily and quickly on different types of water. Raw and softened waters can be tested for total hardness, alkalinity to phenolphthalein and methyl orange, and chloride concentration. Boiler water tests include total and caustic alkalinity, chloride and phosphate concentrations.

In an attractive lightweight transparent plastic case, the kit includes all necessary apparatus, together with polythene bottles containing reagents. The kit comes complete with apparatus, an initial supply of reagents and full instructions for use.

Further information can be obtained from Albright & Wilson (Mfg.) Ltd., or by using the post-paid card.

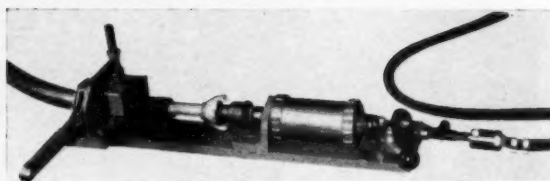
**CPE 928**

### **Hosepipe assembly vice**

To speed the fitting and renewal of connections to hosepipes, the Consolidated Pneumatic Tool Co. have designed a vice, consisting of a 2½-in.-diam. single-acting spring return cylinder with a 3-in.-stroke piston, the cylinder being mounted on a baseplate with a hose clamping vice facing the cylinder and piston and mounted on the same baseplate. The two jaws of the vice are fitted with removable inserts to accommodate different diameters of hosepipe.

Air control is achieved through a

**Equipment for hosepipe assembly.**



single-acting, hand-operated valve to which is fitted an air flow regulator. Sleeves are supplied for the piston rod to suit various types of hose fittings. By gripping the hosepipe in the vice,

fitting a hose connection to the piston rod and operating the air valve, fitting can be carried out in a moment, even in a high-pressure reinforced hydraulic hose.

**CPE 929**

### **Pall rings for packed towers**

Random packing with pall rings is claimed to have given excellent results with packed towers used for absorption and similar applications in the chemical industry. The pall ring has been developed by the Badische Anilin und Soda Fabrik, Ludwigshafen, Germany, and is now being manufactured in Great Britain by Henry Hawkins Ltd.

The perforated ring surface and special arrangement of the inner segments of the pall ring are claimed to have certain very beneficial results, particularly where absorption is concerned. The makers point to the

larger contact surface, larger free area, higher throughput capacity combined with less resistance to gas flow, equal distribution of media and higher rate of mass transfer, along with a self-regulating effect and less peripheral dispersion of liquid.

A recent application of pall rings is for random tower packing in the *Girbotol* plant at the Fawley refinery of the Esso Petroleum Co. Ltd., which produces some 13,000 tons of sulphur p.a., using an aqueous solution of one of the ethanolamines as the absorbent.

**CPE 930**

### **Conical flasks in polythene**

Two sizes of the Erlenmeyer-type *Synert* polythene flask (500 ml. and 1,000 ml. capacity) are offered by Rediweid Ltd. The flasks are moulded from low-pressure, high-density poly-

thene and can be used for operations involving temperatures up to 95°C. (203°F.). They should not be used for boiling liquids over an open flame, neither can they be employed under vacuum at temperatures exceeding 50°C. (122°F.).

*Synert* polythene conical flasks can be converted into suction flasks by fitting suitable polythene nipples.

**CPE 931**

### **Low-resistance testing set**

The *Ducter* low-resistance testing set or *Ducter* ohmmeter is a direct-reading instrument for measuring low resistances from a few ohms down to 1 microhm. It is especially useful for measuring the resistances of switch contacts, rail bonds, armature windings, transformer windings, copper bars, fuses, soldered joints, earth continuity conductors and various other applications where a highly accurate reading is necessary.

The complete set comprises an ohmmeter, one pair of duplex handspikes, one pair of single handspikes and an alkaline battery or cell.

Suppliers are Evershed & Vignoles Ltd.

**CPE 933**

### **CHEMICAL-RESISTANT PIPES**

A range of chemical-resistant pipes fabricated in epoxy resin/glass laminate and sold under the name of *Cortec* are now being offered by Corrosion Technical Services Ltd.

The pipes combine chemical resistance to acids, alkalis, oils and solvents associated with epoxide resins coupled with the high mechanical strength of a resin/glass laminate, and are well suited for carrying corrosive liquors or as steam pipes operating under highly corrosive conditions. They are suitable for operating temperatures in excess of 150°C.

The pipes are manufactured in sizes from 1 to 10 in. i.d. and can be supplied in standard flanged lengths or to specified requirements. Bends, reducing pieces and other 'specials' are also available.

**CPE 932**



## High-temperature heating

Equipment for industrial heating at elevated temperatures is to be manufactured and sold in the United Kingdom by Newton Chambers & Co. Ltd. following a licence agreement with the Struthers Wells Corp., U.S.A. The equipment comprises a range of fired heaters for circulating heating systems of the *Dowtherm* type in addition to those for the direct heating of process materials.

Heating equipment is available in sizes from pilot plant to the largest commercial units and, where possible, it is completely shop-assembled and dispatched ready for installation. Larger units are assembled at site, with a minimum of labour because of

sectionalised construction and simplified designs.

Complete, automatically controlled heating systems including instruments, safety devices, piping and other accessories are available, or the heater may be supplied as a separate unit.

The type of heater most commonly used in the Struthers Wells systems is the vertical type in which heat transfer is predominantly by radiation. For maximum thermal efficiency a bank of heating tubes of the extended surface type is commonly superposed on the vertical radiation-type heater to recover the heat contained in the waste products of combustion by convective means.

CPE 934

## Retaining ring

Almost any application calling for two parts to be held together, or for lateral movement to be prevented, can be considered as a potential job for the *Spirolox* retaining ring, according to the makers. The ring consists of a double turn or spiral of hardened and tempered and polished top-grade

spring steel which has rounded edges to prevent fretting of grooves. It is crimped in the space between the two ends so that it lies flat in its groove.

Further details from Wellworthy Ltd. or from the CPE Enquiry Bureau using the reply-paid postcard and quoting:

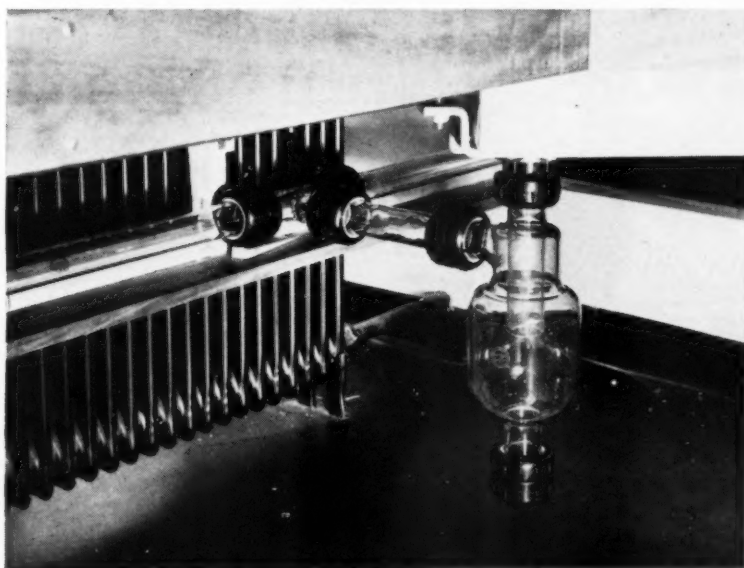
CPE 935

## Gas-liquid chromatography

A new advance in gas-liquid chromatography is claimed by W. G. Pye & Co. Ltd. with the development of

a new type of equipment giving high resolution and high sensitivity.

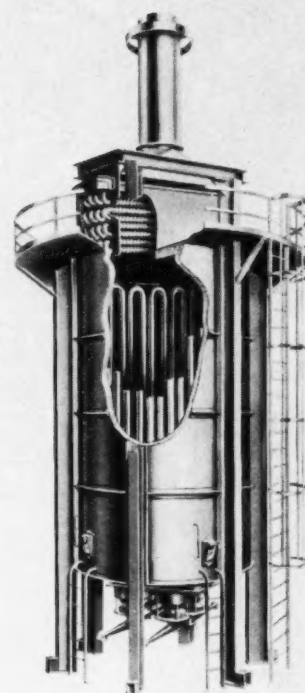
High resolution on short columns



GLASS SINK TRAP

The photo shows a sink trap fitting at the Nottingham Technical College, part of the Q.V.F. glass effluent disposal system described on page 78 of our March issue. A great advantage of the system is that any build-up of solids can be seen straight away.

CPE 936



Exploded view of Struthers Wells direct-fired heater.

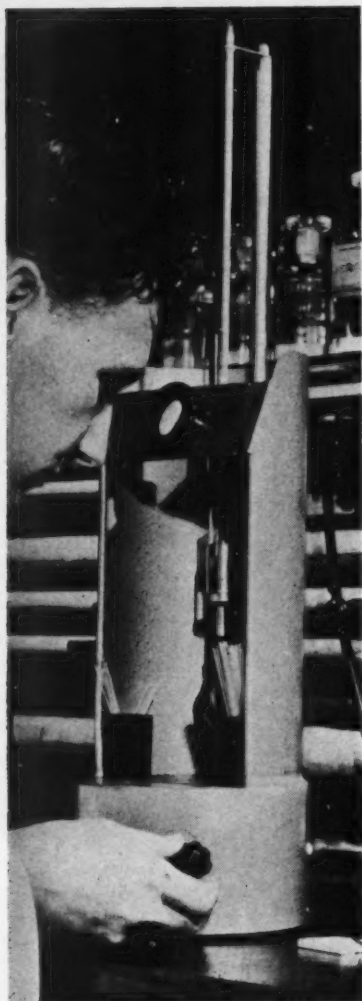
for quick analysis provides the optimum system, but until now, Pye explain, this has been difficult to achieve because it meant the reduction of the proportion of liquid phase and at the same time the sample size; consequently, components in the order of 1% in a sample size of 1 microlitre went undetected. The Pye equipment is especially designed for shorter column work; the proportion of liquid phase has now been reduced from the usual 20 to 30% to 5 to 15%, thus making it possible to achieve 1,000 theoretical plates per foot of column. This is claimed to result in a reduction of retention times and consequently quicker analysis and very high separation.

The Pye equipment is designed to take up to 4 m. of column, but for most analysis work a single-metre column of 3,000 plates is more than adequate to separate the components.

CPE 937

## Melting-point apparatus

A new apparatus for the rapid determination of melting point has been developed by Electrothermal Engineering Ltd. in collaboration with May & Baker Ltd. The apparatus is based on the well-established tech-



Electrothermal melting-point apparatus in use at the May & Baker laboratories.

nique whereby the sample under examination is melted at the bottom of a vertical capillary tube. The particular advantage of this method, according to the makers, is that it can be readily adapted to the determination of melting point under reduced pressure. Under these conditions, certain compounds melt sharply without decomposition, in contrast to a wide melting range with evident decomposition at atmospheric pressure.

Among the advantages claimed for the system are that:

- (1) The physical changes taking place before, during and after melting can be observed in detail.
- (2) The effect of different rates of heating can be studied.
- (3) By inserting tubes at successively

## ★ American Developments in Brief ★

An instrument which will control the levels of liquids, solids and slurries and can be used for high- or low-point detection or proportional control over a narrow range is offered by Automation Products Inc. The probe is a paddle which vibrates at 120 c/s. Rated at 3,000 p.s.i., the instrument will work on 115 volts a.c., is flameproof, corrosion resistant and can be mounted in any position. **CPE 939**

Production of a new extended area, black-body infra-red source and calibration standard has been announced by Radiation Electronics Corporation. A large aperture, 2½ in. in diam., is achieved by means of a specially treated Fresnel surface and the black body operates over a temperature range from 60 to 500°C. with an axial emissivity in excess of 0.99. The unit consists of the radiating source and a self-contained, direct-reading temperature controller. **CPE 940**

An improvement in their patented calcium silicate acetylene cylinder filler which increases its porosity to 92% has been announced by the Linde department of Union Carbide International Co. The new filler is even lighter than Linde's former standard filler and acetylene cylinders are now available which weigh 28.6% less than cylinders containing the old-style charcoal monolithic filler.

The calcium silicate filler is formed inside the cylinder, producing a highly porous (92% void) mass which conforms to the cylinder shape, has virtually uniform density and will not settle or crack in normal service, it is claimed. **CPE 941**

Heat exchangers which are available with graphite, steel or alloy tubes have been designed specifically for heating or cooling of plating, anodising and pickling solutions. A graphite tube exchanger with a *Furacam* plastic pump has proven satisfactory for cooling sulphuric anodising solutions. Pumps to match the exchangers are available in plastic, steel, stainless steel or rubber lined. Fittings are offered in moulded rubber or PVC. **CPE 942**

Featuring a high adsorption capacity, and claimed to be much easier to handle than activated carbon granules of equal volume, activated carbon moulded into cube and wafer shapes is expected to find wide usage in the adsorption of unwanted odours and vapours. If moisture control is also desired, a desiccant such as silica gel can be incorporated. Further information is available from Union Carbide International Co., or from the CPE Enquiry Bureau, using the reply-paid card and quoting: **CPE 943**

A thermosetting coating which resists strong acids (including hydrofluoric), alkalis and solvents is called *Penntrowel* and the makers, Pennsalt Chemicals Corporation, say that rigorous field tests in chemical plants have proved that it also supports heavy-duty traffic and withstands temperatures of 230°F.

It can be trowelled on both horizontal and vertical concrete, brick or cement block surfaces. **CPE 944**

High mechanical and dielectric strength at sub-zero and elevated temperatures, and dimensional tolerances of 0.001 in., are some of the characteristics of a new seamless, glass-reinforced epoxy and silicone structure developed by Chemfab Corporation.

The impregnant is a high-temperature *Epoxy-CL* system which provides a service temperature range of from -320 to +400°F. Other characteristics include dielectric strength up to 500 volts mil thickness; compressive strength of 22,000 p.s.i.; tensile strength (tube) 22,200 p.s.i.; and flexural strength (fibre stress) of over 32,000 p.s.i. Water absorption is limited to 0.24%. **CPE 945**

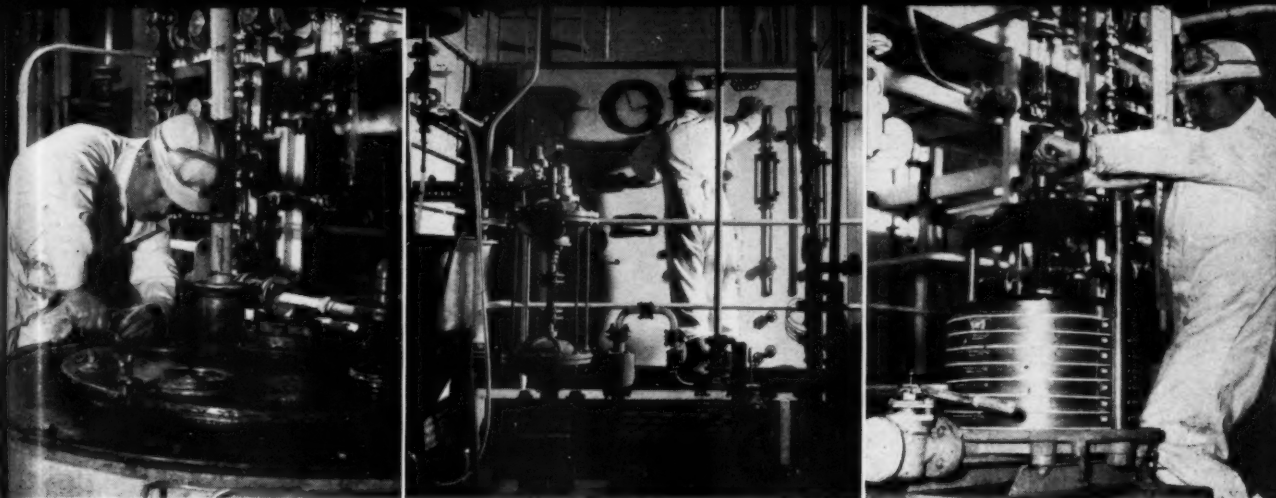
higher temperatures a virtually instantaneous value for melting point can be obtained.

- (4) Sublimation or loss of moisture can readily be seen during melting point determination.
- (5) When the tube is open the evolution of decomposition products can sometimes be detected

(e.g. by inserting a screw of Congo paper in the mouth of the tube to detect hydrogen chloride).

Further details are available from Electrothermal Engineering or by filling in the reply-paid postcard using the number:

**CPE 938**



## New Pharmaceutical Plant for Britain

**A** PHARMACEUTICAL plant which cost some £700,000 to build was recently inaugurated at Gosport, Hampshire. It occupies a 16-acre site and is the first to be built in Britain by Cyanamid of Great Britain Ltd. for its Lederle Laboratories Division. The plant replaces a factory at Hirwaun, South Wales, where crude *Aureomycin* has been refined since 1951.

### 'Aureomycin' refining

The crude material is refined by crystallisation from selected solvents under carefully controlled conditions of pH. The antibiotic is dissolved in 1,000-litre, glass-lined, stirred reactors. The solution is clarified through a Seitz-type filter and pure *Aureomycin* is crystallised. The purified crystals are recovered in a centrifuge, washed with solvents and dried.

A considerable proportion of *Aureomycin* is converted into *Achromycin* by dechlorination. Hydrogenation is carried out in a stirred reactor, housed in a separate room.

### Synthesis plant

Next door to the antibiotics plant is the synthesis plant where drugs such as *Artane* and *Diamox* are manufactured in powder form for the pharmaceutical section.

*Artane* preparation involves a five-stage synthesis and is normally carried out in glass reactors of 10 to 100-l. capacity. *Diamox* is synthesised from relatively simple basic organic chemicals in six stages which include chlorination and acetylation. The various reactions in this synthesis are carried out in fourteen 100-l. glass-lined

vessels and rubber-lined equipment is used for centrifugal filtration.

Chlorine used in this process is received in 1-ton cylinders which are stored in the outside gas station and piped to this department for use.

### Mixing and blending

Powders for tablet manufacture are blended in Morton mixers. The final blend, processed in a Gardner horizontal mixer, consists of active ingredients plus excipients, bonding agents, etc. At various stages preparations such as the gelatine solution are added to convert the powders into a moist mass. This mix is then passed through a high-speed Fitzpatrick mill (by Apex Construction) and emerges as wet granules which are laid on to stainless-steel trays and dried in a L. A. Mitchell oven. When the drying process is completed the dried granules are passed through a second high-speed hammer mill and lubricants are added to ensure smooth running on the compressing machines.

### Ointments and liquids

Fats taken from chemical stores are held in a hot room at a temperature of 80°C. until liquefied. A proportion of the melted fats is pumped into a pre-

mix tank which is situated vertically above the main blending tank, the remainder of the fats being pumped directly from the hot room into the main blending tank where they are held at a temperature of 50°C. The active constituents of the ointment previously micro milled are blended with the contents of the pre-mix tank and the mixture passed through a colloid mill into the main blending tank below. The entire batch is then re-blended and piped to a holding tank where a sample is withdrawn and held under assay.

The general arrangement of the plant in the liquids section follows a similar pattern.

The new plant, employing nearly 300 people, provides high standards of hygiene and of atmospheric and humidity control. For example, all air conditioning duct work and piping for steam, water and electric power and other services for the pharmaceutical section are installed above a suspended ceiling, so providing easy access for maintenance and alteration.

### Heating

The oil-fired heating system is powered by two fully automatic boilers, each with an output of 6,000 lb./hr. of steam. Heating throughout the warehouse and chemical areas is by steam unit heaters. In the chemicals section, all motor and control equipment is of flameproof design, and all unit heaters are provided with fresh-air inlets to replace the air withdrawn by the process extraction equipment.

Builders of the pharmaceutical plant were C.A.S. (Industrial Developments) Ltd.

Above: Three views in the 'Aureomycin' plant at Gosport. Left: An operator adjusts a centrifuge. Centre: The control panel; a proportion of the crude antibiotic is converted into 'Achromycin,' the necessary hydrogenation process being carried out in a stirred reactor in a room immediately behind this panel. Right: An operator adjusts a filter.



# Technology Notebook

Research — Education — Discussion

## New chemical engineering laboratories in Scotland

Work has now started on the new £130,000 research and development centre at Leven, Scotland, for the Balfour group of companies. The main objective of this undertaking is to carry out development work for improvement in the design and operation of chemical process plant for many industries, and to widen the application, fabrication techniques, and uses of new materials of construction.

However, the new centre will have other important functions. It will be available to demonstrate the application of existing designs of plant and process methods to clients' materials, to pioneer new processes and techniques, and to carry out work which would not justify the installation of special pilot plant by individual manufacturers themselves.

The centre will provide training facilities in every sphere of chemical engineering. A student and graduate apprenticeship scheme has already been launched in conjunction with local technical colleges to enable suitable young men and women to reach full professional status, and at the same time to receive valuable practical training in industry.

The arrangement of the building has been planned to co-ordinate current development projects and the housing of equipment from existing laboratories within the group. The main pilot-plant bay will be 160 ft. long, 45 ft. wide, 30 ft. to the eaves, with a tower giving a headroom of 40 ft. but capable of expanding to 56 ft.

A separate pilot-plant laboratory will deal with size reduction, with special reference to dust problems. There will be a specially isolated laboratory for solvent extraction and work with inflammable solvents and noxious gases. Here, radioactive material can be dealt with in comparative safety.

In addition, there will be metallurgical laboratories, dark rooms and other laboratories for corrosion, physical chemistry and general analytical work, along with a chemical development laboratory and two ceramic chemistry laboratories for the glassed steel process of Enamelled Metal Products Ltd. Other Balfour com-

panies include Henry Balfour & Co. Ltd., George Scott & Son (London) Ltd., Ernest Scott & Co. Ltd. and Balfour Lecocq Ltd., as well as a Canadian and an Australian company.

## Engineering education in U.S.A.

At the annual national meeting of the American Society for Engineering Education, to be held at the University of California from June 16 to 20, recent progress towards increasing the effectiveness of engineering and applied science instruction in American schools and colleges will be discussed. Four general sessions of the Society will cover such topics as engineering accrediting procedures, research and the engineering college, improved use of facilities and staff, a survey of nuclear manpower, and the development of engineering faculties.

## Compressed air problems

A proposal to continue co-operative research on problems involved in the mechanical separation of oil and water from compressed air is mentioned in the annual report of the British Compressed Air Society. The first objective of future research will be to determine a method suitable for field, as distinct from laboratory, use of measuring the weight of oil in an air stream in which other substances, particularly water, may be present.

## To Authors of Technical Articles and Books

*The Editor welcomes practical articles and notes on chemical engineering and related subjects with a view to publication. A preliminary synopsis outlining the subject should be sent to The Editor, CHEMICAL & PROCESS ENGINEERING, Leonard Hill House, Eden Street, London, N.W.1.*

*In addition, the Publishers and Editors of the Leonard Hill Technical Group are always ready to consider technical and scientific manuscripts with a view to publication. Correspondence should be addressed in the first instance to the Book Production Manager, at the above address.*

The report recalls that earlier research on this subject, conducted by Mr. C. Webb under the guidance of the Society's hon. technical director and Mr. A. G. Smith, of the City and Guilds College, London, led to the publication of the findings in July 1957.

## Training at Wilton

A training centre planned, with extensions, to meet requirements for many years to come, has been opened at the Wilton works of I.C.I. The new centre will be the hub of a wide circle of training activities for all grades of employees, from apprentices to foremen and senior staff. In addition, in September this year a new scheme of training—a commercial student apprentice scheme—will be inaugurated.

## Materials handling

The National Joint Committee on Materials Handling, a co-ordinating committee for professional and other bodies interested in materials handling, particularly from an educational standpoint, has compiled a list of films on this subject which is now obtainable by sending a stamped addressed envelope, from the Secretariat, National Joint Committee on Materials Handling, 20-21 Took's Court, Cursitor Street, London, E.C.4.

The list covers such widely differing subjects as the operation of a high-capacity floating grain-handling plant, the handling of *Coca Cola* cases on the production line, the application of the unit load system to sausage and pie manufacture, excavators moving 700 tons of earth an hour, the use of tractor equipment in vineyards and cargo handling at the ports.

## Atom school for businessmen

A course designed to give senior executives in industry an appreciation of the possible applications of radio-isotopes will be held at the Harwell Isotope School from September 23 to 26. Application forms are obtainable from the Registrar, Isotope School, Atomic Energy Research Establishment, Harwell.

## Industrial applications of chemistry

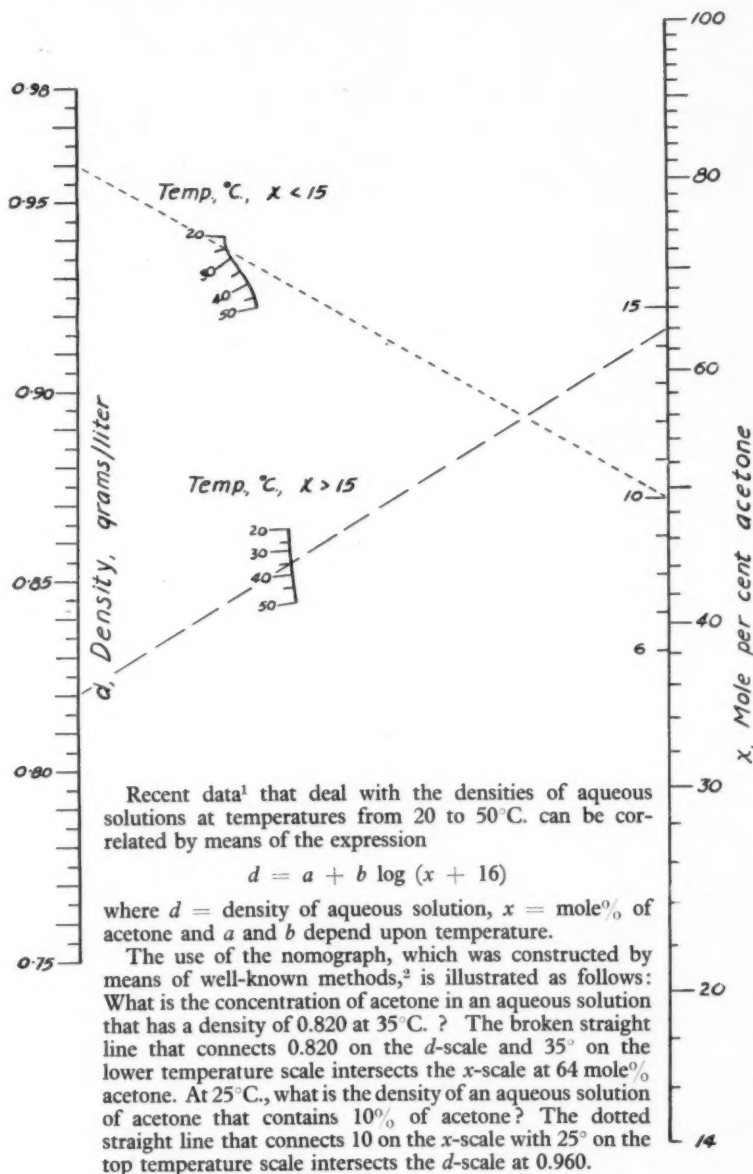
The 31st International Congress of Industrial Chemistry will be held from September 7 to 20, 1958, at Liege, Belgium. The Congress is organised by the Société de Chimie Industrielle, Paris, with the collaboration of the Federation des Industries Chimiques de Belgique.

# Nomogram:

## Densities of Aqueous Solutions of Acetone

By D. S. Davis

(Head, Department of Pulp and Paper Technology, University of Alabama)



### REFERENCES

- <sup>1</sup>K. T. Thomas and R. A. MacAllister, *Amer. Inst. Chem. Eng. J.*, 1957, 3 (2), 161.
- <sup>2</sup>D. S. Davis, 'Nomography and Empirical Equations,' Chap. 10. Reinhold Publishing Corporation, New York, 1955.

## Recent Publications

**Terylene.** Published recently was a new multi-lingual edition of a well-illustrated booklet by I.C.I. describing the history and uses of *Terylene* in industry. Enquiries to Imperial Chemical Industries Ltd., Millbank, London, S.W.1.

**Temperature recording.** An illustrated pamphlet describing their range of thermographs and index thermometers has been put out by the Cambridge Instrument Co. Ltd., Friern Park, N. Finchley, London, N. 12.

**Oil refinery.** A new booklet describes, with lavish illustrations, some of the features of the Coryton oil refinery. Copies are available from the Mobil Oil Co. Ltd., Caxton House, Tothill Street, London, S.W.1.

**Air separators.** Sturtevant Engineering Co. Ltd. have replaced their publications 8701 and 8703 with No. 8704 which describes the various mechanical air separators manufactured by the company. Copies may be obtained from them at Southern House, Cannon Street, London, E.C.4.

**Industrial corrosion-resistant products.** A new four-page bulletin describing a complete line of carbon and graphite products for the chemical processing and other industries is available from Catalog Section RS-5008, Union Carbide International Co., 30 East 42nd Street, New York 17, N.Y., U.S.A.

**Water coolers.** Examples of the applications of *Visco* steel-shell water coolers are given in illustrated brochure No. 579 by the Visco Engineering Co. Ltd., Stafford Road, Croydon. The illustrations also show how these compact units can be adapted to site conditions and erected in the most convenient position indoors or outdoors, in a corner or passage, on a roof or on steel supports.

**Model programme.** Scale models are discussed as a tool to communicate engineering concepts and to improve methods of designing process plants in a new booklet published by the M. W. Kellogg Co., 711 Third Avenue, New York 17, N.Y., U.S.A.

**Basic chemicals.** The industrial chemicals division of Olin Mathieson Chemical Corporation, 460 Park Avenue, New York 22, has issued a 16-page booklet describing the characteristics, grades and containers for 24 basic chemicals used by industry. The booklet contains information on organic, inorganic and other chemicals, and lists the location of the production points for each product.

# Company News

Joshua Hindle & Sons Ltd. announce that a new company, Hindle-Hamer Francaise S.A.R.L., has been formed in France, with its head office at 6 Avenue Franklin-Roosevelt, Paris 8. The products formerly manufactured by Joshua Hindle at Leeds, under licence from Hamer Valves Inc. of California, U.S.A., will now be manufactured in France. This range includes the Hindle-Hamer line blind valves, visible wedge valves and leakproof gate valves.

Monsanto Chemicals Ltd. and R. H. Cole & Co. Ltd. announce that they have come to an agreement under which Monsanto acquire, as an investment, 50% of the ordinary share capital of R. H. Cole & Co.—a private company engaged in the marketing of raw materials and equipment to the plastics, chemical and electrical industries. It will remain as a separate entity under its own board of directors, with Mr. R. Hugh Cole and Mr. Peter H. Cole continuing as joint managing directors.

The formation of a new company, Croda Belge, with head office at Verviers, Belgium, is announced by Croda Ltd. The company will manufacture lanolin for the cosmetic and pharmaceutical industries and use it to make anti-corrosive compounds in Belgium where there are no existing lanolin factories.

The Sir George Earle Trophy for a notable achievement in the cause of industrial accident prevention has been awarded this year to Imperial Chemical Industries Ltd. 'in recognition of the far-sighted policy of its board and its attitude towards the problems of industrial accident prevention and of the altruistic and generous way in which the extensive safety knowledge accumulated within its own organisation has been made available continuously to industry throughout the world.'

This is the third time the trophy has been awarded. In 1956 the recipients were H.M. Inspectors of Factories, and last year it was awarded to the Birmingham and District Industrial Safety Group.

The manager in charge of production of a number of chemicals at the Rhodes, Australia, factory of C.S.R. Chemicals Pty. Ltd., Mr. J. Tanner,

recently spent some time at the British Celanese factory at Spondon to gain experience in the operation, control and management of vinyl acetate production. C.S.R. Chemicals' new vinyl acetate plant, which is expected to be 'on stream' next June, is being built to a design in collaboration with British Celanese, who are providing the know-how and technical assistance for the production of this chemical in Australia. The plant, which will come under Mr. Tanner's control, is the first of its kind in Australia, vinyl acetate having been previously imported.

A new plant is being built by I.C.I.'s Heavy Organic Chemicals Division at Billingham, Co. Durham, for the extended production of octylphenol and other alkylated phenols. I.C.I. is already a major manufacturer of these chemical products.

The company recently announced a substantial reduction in its home trade price for octylphenol to a level which is closely comparable with the U.S. domestic price.

The chemical pump division of the Candy Filter Co. is now operating as a separate company under the name of Metering Pumps Ltd. at 21 The Mall, Ealing, London W.5. The company is exhibiting at the Chemical and Petroleum Engineering Exhibition, and details are given in the Preview which appears in this issue.

## Changes of address

The Power Plant Division of Elliott Bros. (London) Ltd. has moved to

larger office premises adjacent to their associates, James Gordon & Co. Ltd., at Dalston Gardens, Stanmore, Middlesex. The Elliott move covers sales projects and contracts office only, engineering and production remaining at the Lewisham works.

Audley Engineering Co. Ltd. have transferred their London offices to 60-61 Trafalgar Square, London, W.C.2.

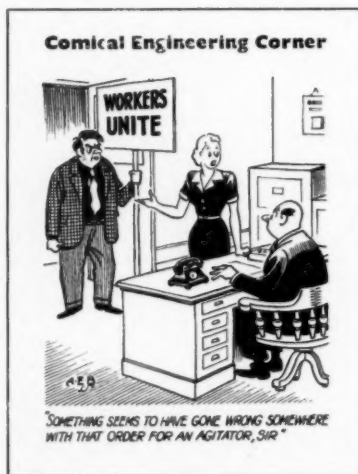
## British Standards

**Terms for powders** (B.S. 2955: 1958, 4s. 6d., 'Glossary of terms relating to powders'). This new British Standard (14 pp., fully indexed) defines a number of selected terms applicable to metallic and non-metallic powders. Following a definition of powder are sections containing terms associated with types of powder, particle size, particle shape, powder properties and powder processing.

**Microchemical apparatus** (B.S. 1428). Three further parts of this standard just published are: Part F1, 'Filtration apparatus for microchemical purposes' (4s. 6d.); Part G2, 'Vacuum drying ovens for microchemical purposes' (4s.); and Part K1, 'Vaporimetric molecular weight determination apparatus' (4s.). As a result of experience in the use of this apparatus and developments in technique, a revised edition of Part A1, 'Carbon and hydrogen combustion train (Pregl type)', specifying various modifications to the standard which first appeared in 1950, has also been published (5s.). Copies obtainable from the B.S.I., Sales Branch, 2 Park Street, London, W.1.

**Solvents and allied materials** dealt with in eight British Standards that are now being issued include: 'Di-n-butyl phthalate' (B.S. 573: 1957), 'Carbon tetrachloride' (B.S. 575: 1957), 'Diethyl ether (technical)' (B.S. 579: 1957), 'Tritolyl phosphate' (B.S. 1999: 1957), 'o-dichlorobenzene, Grades A and B' (B.S. 2943/4: 1957), 'Formaldehyde solution' (B.S. 2942: 1957) and 'Paraformaldehyde' (B.S. 2941: 1957). Four of these are revisions of earlier standards and they now reflect improvements in the qualities of material currently available.

The two standards for o-dichlorobenzene are published in one volume costing 4s. 6d.; the remaining standards cost 4s. each. Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1.





# World News

## SOUTH AFRICA

### Nitrogen plant contract

African Explosives and Chemical Industries Ltd. have announced that they are increasing the capacity of their No. 2 ammonia unit at their Modderfontein factory and that they have awarded certain contracts for extensions and additions to this unit to the Power-Gas Corporation Ltd., Stockton-on-Tees, England, and their associate Ashmore, Benson, Pease & Co., Africa (Pty.) Ltd., of Johannesburg.

The contract for the gasification section covers modifications to the existing fixed-bed dry-base generators which are to be converted from cyclic semi-water gas operation to continuous oxygen/steam gasification. The fuel to be gasified is coke produced by the low-temperature carbonisation of local non-caking coals. These modifications, together with extensions involving the installation of two new generators, are to be carried out by Ashmore, Benson, Pease & Co., Africa (Pty.) Ltd. to the designs of Power-Gas.

The detailed engineering, supply and erection of the extensions to the gas purification sections of the existing plant will be carried out by Power-Gas in accordance with basic design data supplied by A. E. & C. I. and Imperial Chemical Industries Ltd. (Billingham Division). These extensions, which are to be integrated with the existing plant, comprise equip-

ment for CO conversion at low pressure; carbon dioxide removal and recovery using water wash; and high-pressure carbon monoxide removal using copper liquor wash and final purification.

The increase in the ammonia synthesis capacity of the No. 2 unit will be met by a new synthesis section to produce the additional requirements of anhydrous liquid ammonia. This plant will be designed by I.C.I. (Billingham Division), and engineered and supplied by the Power-Gas Corporation Ltd. with the exception of the synthesis converters which I.C.I. will themselves supply direct to A.E. & C.I.

## INDIA

### Antibiotics plants

A Rs. 15-million streptomycin plant is to be constructed following an agreement between Hindustan Antibiotics, the State-owned penicillin factory at Pimpri, near Poona, and an American firm.

The plant is expected to go into production in two years' time and will produce 45,000 kg. p.a. Meanwhile, the penicillin plant at Pimpri is being expanded. Manufacture of further antibiotics, such as *Aureomycin*, *Terramycin* and *Acromycin*, is envisaged for the Pimpri factory in the future.

### Factories for Punjab

A calcium carbide factory will be set up in the Punjab in the private sector. It has also been decided to set up a newsprint factory in this area.

## GREAT BRITAIN

### Tonnage oxygen for gas industry

A tonnage oxygen plant to be installed at the North-Western Gas Board's new hydrogenation plant at Partington, near Manchester, will be capable of producing nearly 63 tons of oxygen per day. The oxygen will be used for the partial oxidation of oil for the purpose of producing hydrogen which will be used to hydrogenate further quantities of oil in order to produce town's gas. Later, coal will be used as the raw material.

The contract for the tonnage oxygen plant was placed with Air Products (Great Britain) Ltd., by Humphreys & Glasgow Ltd., who are the main contractors. A feature of the plant is the oxygen compression system, which uses liquid oxygen pumps for delivering the oxygen under pressure.

## BELGIUM

### New chemical company

A new Belgian chemical company, S.A. Argus Chemical, has been registered. Its capital has been subscribed jointly by Union Chimique Belge S.A. and Argus Chemical Corp. of America. The new firm will manufacture, under licence of the Argus Chemical Corp., stabilisers and plasticisers especially for vinyl chloride polymers. The Belgian company will have the exclusive rights for products at present manufactured by Argus Chemical Corp. in all countries except the United Kingdom, Yugoslavia and Scandinavia; also in Africa, except in Commonwealth countries, and in Brazil.

## BOLIVIA

### Copper plant proposal

The Ministry of Mines was recently reported to be studying a proposal for the establishment of a copper concentration plant in the Llangera region which is known to contain rich mineral deposits. Reserves of copper in the region are estimated to exceed \$230 million. It is argued that the area could support a new colony and that machinery at present not being utilised by the Corporacion Minera could be put to good use in the plant.

## UNITED STATES

### Dense soda ash

Completion of new facilities at Saltville, Va., to produce and store dense soda ash has been announced by the industrial chemicals division of Olin Mathieson Chemical Corporation. Cost of the construction programme is estimated at more than \$1 million.

Addition of dense soda ash at the Saltville plant is to meet current and future needs of the glass industry, which annually consumes some 1.8 million tons. The plant will continue its regular production of light soda ash.

## PORTUGAL

### Industrial projects

A large factory for making wood pulp and paper from Portuguese eucalyptus is to be set up at Setubal; it is to be established by a new company.

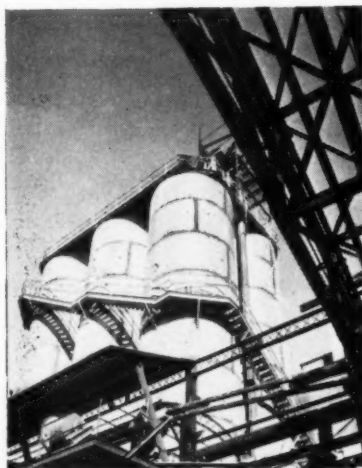
Other projects in the Setubal area include a tyre factory.

## PHILIPPINES

### New industries

Super Chemicals Corp., Roman Santos Building, Manila, has been formed (capital £1 million) to manufacture chemicals and acids.

The Philippine Cellulose Corp., 516



Six new dense soda ash storage bins at the Olin Mathieson Chemical Corp., Saltville, Va., plant.

Madrigal Building, Manila, has been formed (capital £300,000) to manufacture cellulose pulp, paper, chip-board and fibreboard.

#### SWEDEN

##### Industry investments

An investigation by the Kommer-skollegium and the Industrial Institute shows that total capital investment by Swedish industry (both publicly and privately owned) in 1958 is expected to be about 8% greater than last year. The actual increase in 1957 was about 4%. In 1956 total industrial investment amounted to kr. 2,812 million and in 1957 to kr. 2,930 million, whilst the estimate for 1958 is kr. 3,184 million. Investments are expected to increase mainly in the mining, metal, engineering and food industries and in electricity, gas and water works. Industries in which investment is expected to fall include the pulp, paper and printing industries and chemicals and certain products of the chemical industry (e.g. detergents, soaps and paints).

#### The Leonard Hill Technical Group—June

Articles appearing in some of our associate journals this month include:

**Manufacturing Chemist**—Nitrofurans and Pharmaceuticals; SKF Factory at Tonbridge; Ethylene Oxide Condensation Products in the Soap Industry; Non-ionic Surface-active Agents; Alcohol and Alcohol-metry.

**Petroleum**—Nickel and Cobalt Catalysts in the Petroleum Industry; Instrumentation at Tidewater Oil Refinery; Recent Progress in Sulphuric Acid Alkylation.

**Corrosion Technology (Plastics Issue)**—Plastic Coatings for Buried Pipes; Plastic Piping Materials in Anti-corrosive Applications; The Right Plastic for the Pipeline Job.

**Automation Progress**—Electronic Controls at a Modern Sugar Factory; Instrumentation of Chemical Process Plant; Programme-controlled Roughing in an American Steel Mill.

**Paint Manufacture**—Surface Coatings Derived from Tall Oil; Second Conference of the Association of Printing Technologists; Review of Plant and Equipment.

**Food Manufacture**—Review of Laboratory Furnishings and Equipment; Science and Sugar Confectionery; Repairing Water Pipes by Freezing.

**Atomics**—Safety for Atomic Workers; Ground Disposal of Radioactive Wastes; Radiation and its Hazards.

## Personal Paragraphs

★ **Mr. R. F. Simmons**, who was with the Kestner Evaporator & Engineering Co. Ltd., has been appointed sales manager to Appleton & Howard Ltd., and will be resident at the company's London office.

★ **Sharples Centrifuges Ltd.** announce the appointment of **Mr. C. L. Smith** as project engineer (northern England) to assist **Mr. G. H. Duffield**, who is senior project engineer of that area.

★ **Dr. E. W. R. Steacie**, president, National Research Council of Canada, has been elected an Honorary Fellow of the Chemical Society of London. His principal work is in the field of gas reactions and photochemistry and is the author of three books on chemistry and over 200 scientific papers. The Chemical Society was founded in 1841, has over 9,000 members, and elects an Honorary Fellow about once in two years.

★ **Mr. George Boex**, a former managing director of the British Aluminium and associated companies, has retired from the board by rotation and, owing to advancing years, does not wish to seek re-election. He will continue in a consultative capacity.

★ **Imperial Chemical Industries** recently announced the appointment of **Mr. R. G. Hoare** to the board of the Pharmaceuticals Division.

★ **Mr. R. C. Hesketh-Jones**, formerly sales director (industrial division) of British Oxygen Gases Ltd., has been appointed chief executive (overseas) at the head office of the British Oxygen Co. In this capacity he will handle the overseas affairs of the Group in direct association with the managing director, **Mr. T. E. Potts**. **Mr. R. J. Foster**, D.F.C., A.F.C., who has recently been director and general manager of British Oxygen Aero Equipment Ltd., succeeds Mr. Hesketh-Jones.

★ **Mr. S. H. Clarke**, C.B.E., has been appointed Director of the new research station now being built for the D.S.I.R. at Stevenage for fuel and process research. Mr. Clarke is the present Director of the fire research station at Boreham Wood. The programme of the new station will include, as major items, researches on atmospheric pollution, the production of oil from coal and aspects of mineral processing.

★ At the 38th annual general meeting of the British Chemical Plant Manufacturers Association, held in London on May 1. **Mr. H. W. Fender**, vice-chairman and managing director of Prodorite Ltd., was elected chairman of the Association for the ensuing year. He has been a member of the B.C.P.M.A. council and the executive committee since 1951 and served as a vice-chairman from 1954 to 1956. The following were elected to the council: **Mr. J. Bishop** (Nordac Ltd.), **Mr. J. C. Haithwaite** (John Thompson (Dudley) Ltd.), **Mr. I. M. O. Hutchison** (Henry Balfour & Co. Ltd.), **Mr. B. H. Turpin** (Q.V.F. Ltd.) and **Mr. M. Wyndham** (Bennett, Sons & Shears Ltd.). At its quarterly meeting after the annual general meeting the council elected the following officers: *vice-chairmen*—**Mr. N. C. Fraser** (W. J. Fraser & Co. Ltd.), **Dr. R. Lessing** (Hydronyl Syndicate Ltd.) and **Mr. P. W. Seligman** (A.P.V. Co. Ltd.); *hon. treasurer*—**Mr. M. Wyndham** (Bennett, Sons & Shears Ltd.).

★ **Mr. J. B. Davies**, joint sales manager of Lawes Chemical Co. Ltd., has been appointed a director. He joined the company as a junior member of the staff in 1944.

★ **Mr. T. F. W. Jackson** has been appointed chairman and managing director of Union Carbide Ltd. in succession to **Mr. W. B. H. Galloway** who died last December. Mr. Jackson, an Australian, joined the Union Carbide organisation in 1940, but later became engaged in war service, re-joining the company in 1946. During the eight years which followed he worked his way to the position of assistant managing director. In that capacity he was in charge of Union Carbide's three plants in Australia and one in New Zealand manufacturing dry batteries and strip zinc and ground manganese ore for use in battery plants in Australia and the East. In October 1954 he became managing director of National Carbon Philippines Inc. (another Union Carbide concern). In the Philippines, he also became president of Maria Cristina Chemical Industries Inc. (a partially owned subsidiary of Union Carbide), which manufactures calcium carbide at Iligan City, Mindanao. Mr. Jackson is also a director of Union Carbide's affiliated companies, Gemec Ltd. (chairman and managing), Bakelite Ltd. and British Acheson Electrodes Ltd.

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